Editorial

WITH this issue we commence a series of articles designed to help readers who would like to become transmitting amateurs. The necessary licence, granted after passing an examination held by the PMG's Department, allows the holder to operate his own private station, and to carry out experiments with other amateurs.

Recently a new type of licence has been created which does not require the holder to pass a test in the Morse Code. This requirement has always been a stumbling block to aspiring transmitters, and a licence omitting it has been long overdue.

In the early days of radio, Morse Code was the universal means of communication, and unless one was able to use it, operation was impossible. It is still useful today, for code signals can often be heard when signal strength is too weak for telephony. But, in general, the spoken word has supplanted it to such an extent that its importance is very greatly reduced for anything but fast, machine sending.

The time and concentration needed to achieve even 14 words per minute has been more than many could afford in the modern, well-filled world; but truly old customs die hard. The new licence allows operation only on the bands at 144 Mc and higher; but fortunately these are the bands where the great interest now lies, and where there is still much genuine experimenting to be done.

While grateful that the PMG has made a concession by introducing the new licence at long last, I am still disappointed that he is adamant about opening the bands to novices. Such licences are very popular in America, where amateurs are apparently valued much more highly than in this country, despite the fine record of national service in peace and war built up by Australian amateurs.

My disappointment is shared by many who feel that amateur encouragement is essential if the amateur body is to grow and prosper instead of ultimately dying of old age.

What others have done, we should be able to do. The Wireless Institute of Australia, the representatives of Australian amateurs, should not rest until amateur privileges are made available not only to the codeless experimenters on VHF but also to the beginners in radio who would gain so much by learning while they operate.

In the meantime I sincerely hope our articles will help many of our readers across the more difficult and unfamiliar roads which lead to a "ticket", because I know how much they will benefit from joining the amateur ranks.

John Moyle

INDEX

	Page
Sending TV By Microwaves	3
Back To School By Television	4
Latest Design For TV Relays	7
The Structure of the Earth	9
Twenty Million Years After	13
Miracle of Modern Light	14
Technical Review	19
A De-Luxe Crystal Set	28
The Serviceman Who Tells	33
A Course in Television	38
Speaker Voice Coil Fitters	42
Here's Your Answer, Tom!	52
A Reader Built It	55
The D/W Standard Five	56
How To Get Your Amateur Licence	67
Standard Amplifier No. 1	70
Trade Reviews and New Releases	79
Let's Buy an Argument	84
Off The Record	90
Record News From Abroad	94
What Makes A Good Studio	95
Short Wave Notes	98
Amateur Notes By Bill Moore	99
Answers to Correspondents	109

RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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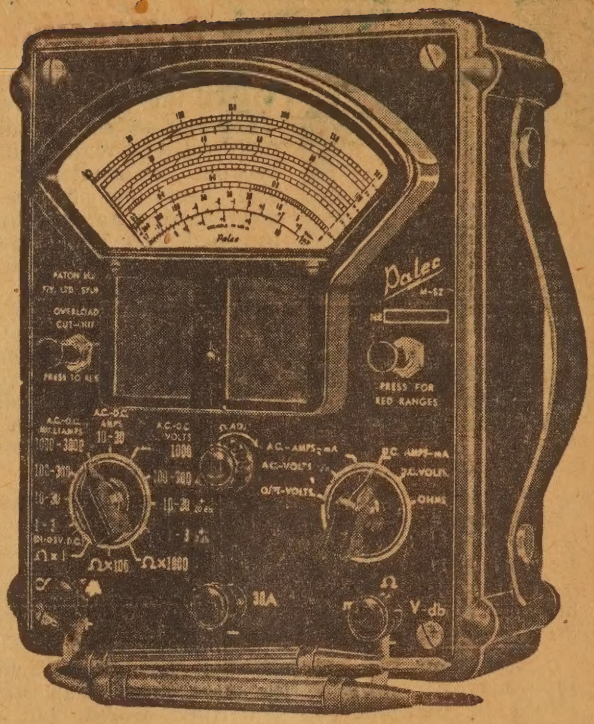

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Ohms (int. Bat.) 0-3000: 0-300,000: 0-3 megohms	3
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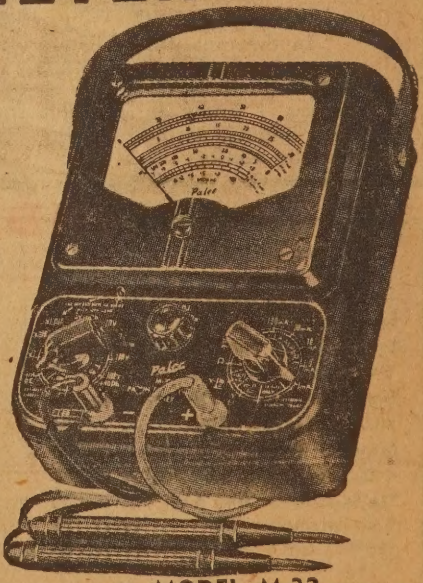

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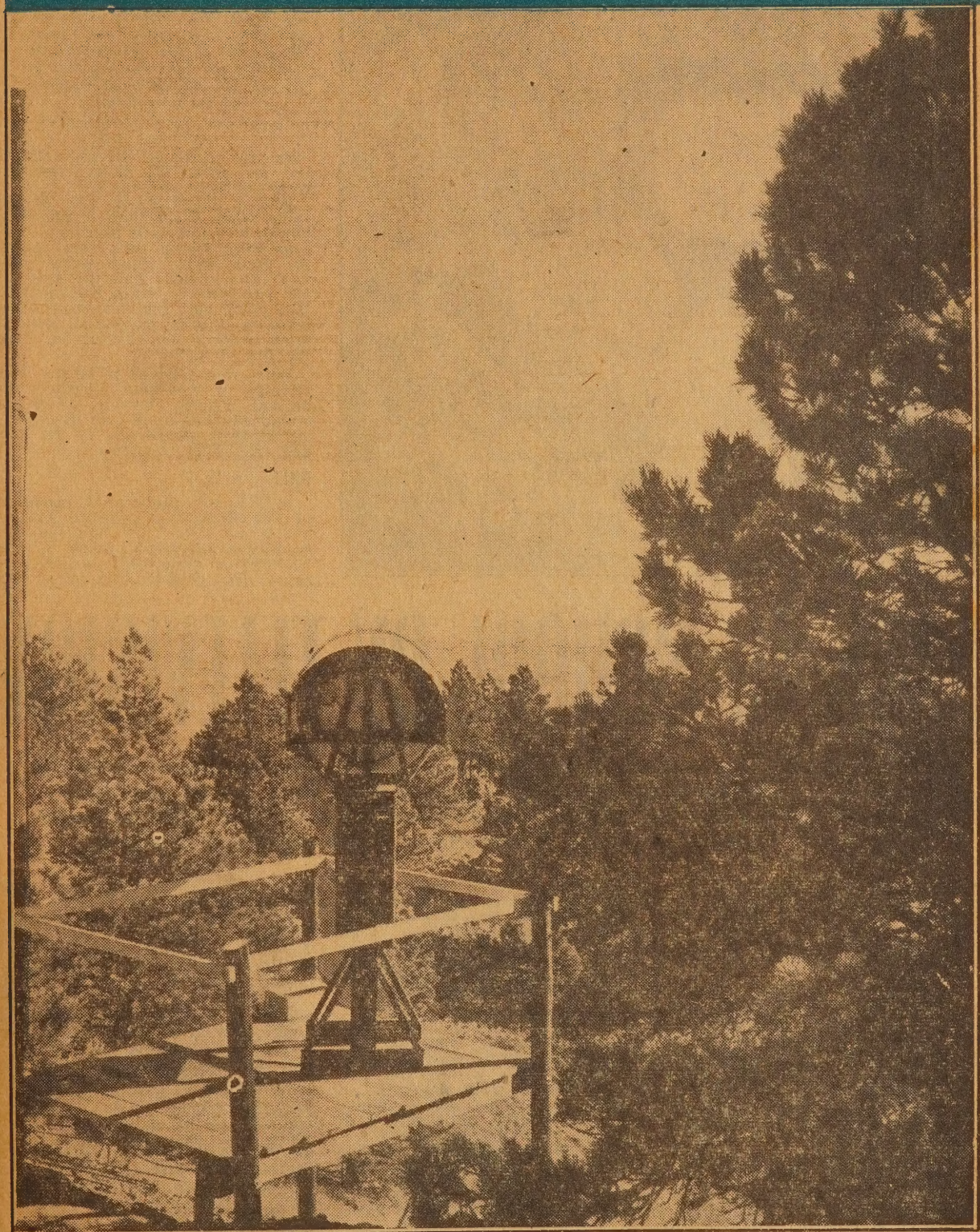
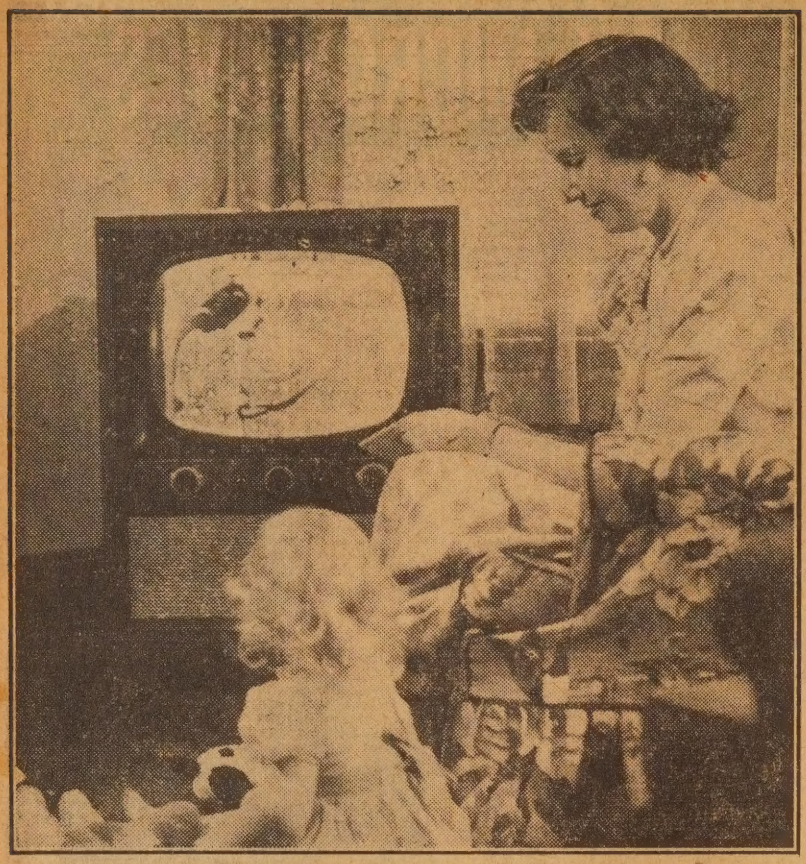
SENDING TV BY MICROWAVES



High above the surrounding country this microwave TV repeater station operates unattended with a main station 14 miles away. Its parabolic aerial which feeds signals into the equipment enclosed below carries not only TV video and sound but a second contact circuit as well. (Story page 7).



Thousands of housewives in the viewing area of the General Electric TV station WRGB, put aside their morning duties long enough to pick up a little more education. One of the programs which rivalled home-making shows and soap operas was "Shortcut with Shorthand". Mrs. Julia MacNair above found that for half an hour she was able to "attend" a shorthand class and keep an eye on her 18-months-old daughter at the same time.

BACK TO SCHOOL BY TELEVISION

While man remains what he is entertainment will continue to be the prime output of television. But gradually the educational possibilities of the medium are being recognised, and interested groups in the USA are now experimenting to find how best to cater for a "television student body." A sideline at present, the importance of the experiment is growing.

AMONG the experimenters is the General Electric station WRGB. It has just concluded its first year with a television student body of 10,500 schoolchildren and a "faculty" of nearly 3000 in the four-State area it covers.

In addition to the children there are thousands of housewives who view "TV Schooltime" and take part in the sessions. Almost reluctantly they have put away their notebooks for the summer vacation period in which "TV Schooltime" goes into recess.

In co-operation with the Mohawk-Hudson Council on Educational Television, Inc., WRGB has scheduled an hour of educational programs five days a week since September 14, 1953. In all, 430 programs were presented to the classes in eastern New York, Connecticut, Massachusetts, and Vermont.

The TV council, which might serve as a useful pattern for similar activity in Australia when TV makes its bow, is composed of more than 130 civic, cultural and educational organisations. Virtually every parochial school and institution of higher learning, as well as most public schools in the area are members.

An incomplete survey by the council shows that more than 10,500 schoolchildren were viewing these classes, indicating that final results will reveal more than 20,000 viewing some individual programs.

TV "FACULTY"

The 3000-member "faculty" for "TV Schooltime" included researchers, artists, script writers and performers, drawn from the ranks of teachers, business people, students and housewives—anyone associated with the programs' production.

The long-distance students took a multitude of subjects ranging from speaking French to making ice cream, from breeding birds to sculpturing, from mental health to fixing loose legs on chairs, and from studying the effects of atom power to speaking Spanish.

Biggest surprise of the season came when more than a thousand housewives indicated shorthand lessons were vieing with soap operas for their time. Some wrote they had never before had the time to learn shorthand; others needed it to take down club minutes; some were learning it with secretarial jobs in mind, and a few did it just for the fun of it.

What was believed to be the first attempt of television educators to present French lessons to grade school students scored an unexpected hit as it gained one of the largest "in-school" audiences.

FREE TALENT

Miss Angela McDermott, producer of "TV Schooltime", admits everyone is not a born TV star, but she credited a majority of teachers with "better-than-expected" performances. The children, she added, are naturals on television because they are unrestrained and relaxed.

All of the talent for educational television is given free except for the producer and secretary. Teachers carry out their television assignments as part of their teaching job.

To offset some of the expenses, which run about 10,000 dollars annually, WRGB donated 2500 dollars to the council during the first year and has raised that amount by 500 dollars for the approaching school year. This is in addition to furnishing professional studio personnel, facilities and the daily hour of television time. The remainder of funds are furnished by the member organisations, assessed by the number of students they represent. In the cases of civic and cultural groups, a flat fee is charged.

"We feel we have established a clear indication of the ability of commercial stations to handle the requirements of educational television," R. B. Hanna, manager of the G-E Broadcasting Stations Department said. "The benefits of professional help have been plainly de-

From our New York Office

monstrated in the experiments of the past school year."

The program schedule is now being prepared for the next 39-week series of educational television which will commence September 13. As with this year's classes, about half will be devoted to grade and high school children, while the remainder will be directed at adults.

There are many in commercial television who feel that the medium today faces a challenge to open up new intellectual worlds. Among them is Dr. Bergen Evans, Professor of English at North-western University whose reputation for being "witty and interesting" in his lectures led to an appearance on TV, and, subsequently, to introduction of his own programs, one of which has been running for more than three years.

Television, he believes, is suspended about evenly between silliness and culture. "Television," he says, "is a terrible power for evil as well as for good."

According to Dr. Evans, curiosity is a passion., "That's why people get educated in spite of teachers and schools," he maintains. "Television can and must fulfil the urge to know."

Characteristically, he suggests this urge should not include merely the wanting to know how Hopalong Cassidy is making out. He thinks that too great an emphasis along these lines is an interference with the true learning process. Not that there's anything intrinsically wrong with them.

"But too much of the superficial in TV is comparable to a 19th century person spending too much time reading Thackeray, or Walter Scott, or Hugo. There's not enough substance there to demand all that time," Dr. Evans maintains.

"Television's greatest opportunity is opening up new intellectual worlds for people, in the sciences, in literature, in art."

NEW WORLDS

He scoffs at those who say few are interested in such things, and adds, "Curiosity to know is something we find in the lowest mammals and it gets stronger as you go up the anthropological scale."

He is of the opinion that any subject, interestingly presented, will have an audience. "I've got a lecture on poetry I'd be willing to give to a bricklayers' union."

Once the fear-imposed prohibition of intellectual shows is put aside, knowledge can come into its own on TV, is his firm belief. In support he cites the great start in TV educational shows being made in the fields of natural history and science. His own TV show in these fields was in danger of going off until the stagehands and electricians protested so vigorously that the amazed front office relented.

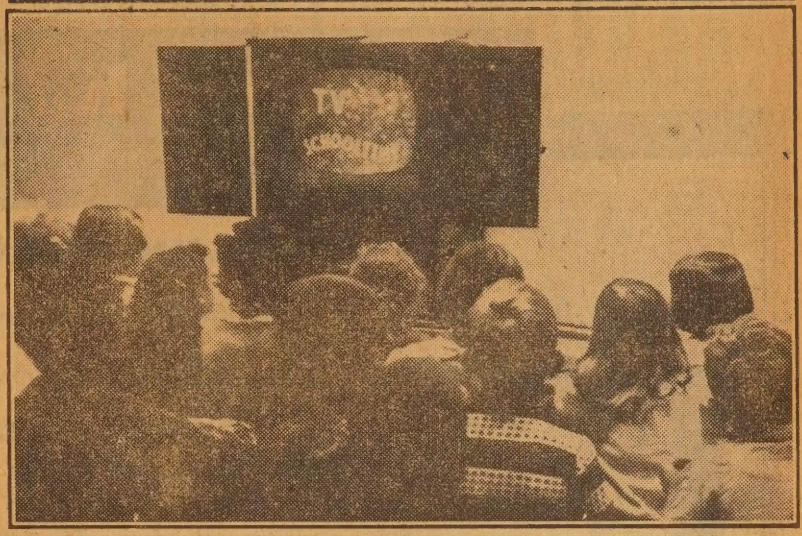
Another field where Dr. Evans thinks there is a good opportunity is that of public affairs. If this might lead to controversy, so what? is his attitude.

"We ought to quit quailing in front of militant lunatics," he declares.

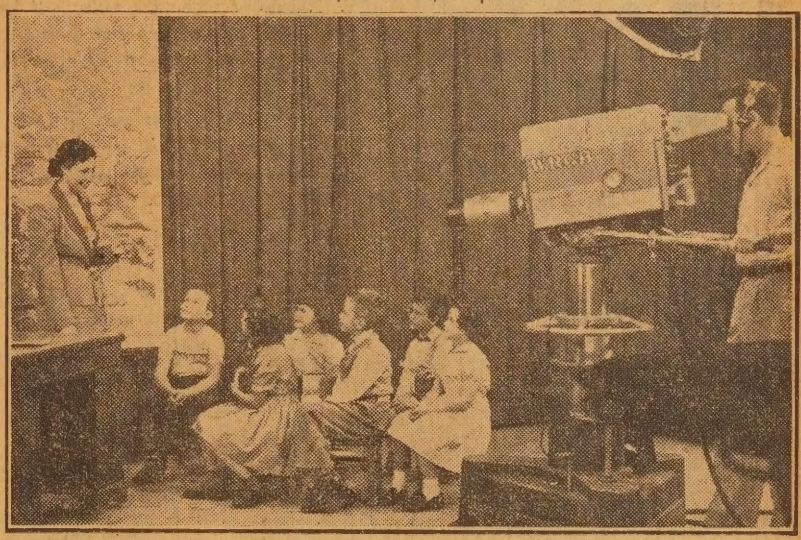
There's only one field of learning Dr. Evans has his doubts about —philosophy.

"The tired masses, home from a hard day's work, probably couldn't work up much interest in the 'Why' of things," he said.

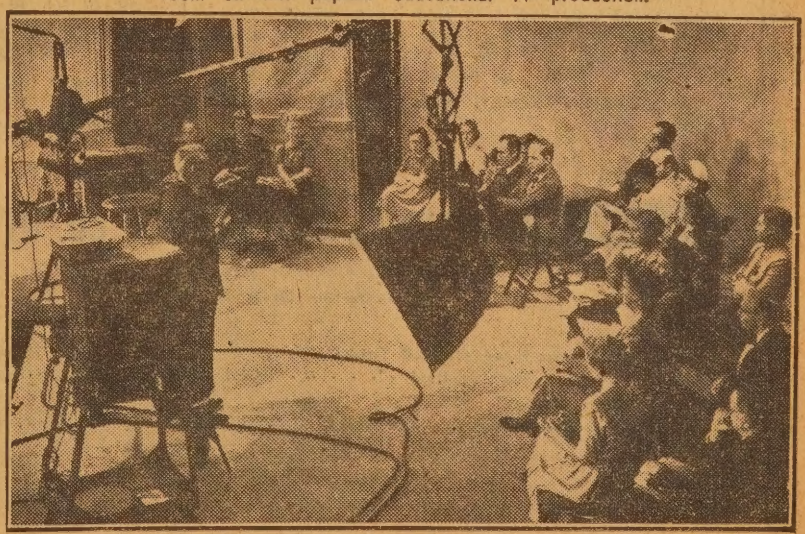
HELPS PARENTS AND CHILDREN



The new teacher in the classroom enters via television and her classes consist of from 3,000 to 20,000 persons.



Having "Fun with French," six grade school children are part of the ta'evised classroom on this popular educational TV production.



Television workshops gave teachers instruction in preparing programs.

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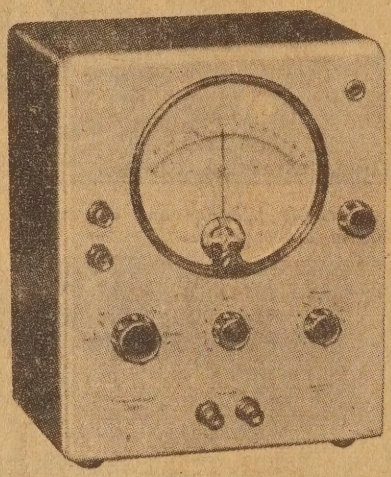

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Type 1502 and 1507

has been designed for use primarily in the production inspection of resistors, capacitors, and inductors. Operationally, the percentage of deviation of the component to be tested from a standard component is read on a large illuminated scale. The scale itself has two ranges. The indicating meter is of the moving coil type and is equipped with a specially constructed pointer to aid in reading. The Deviation Test Bridges have a very high indicating speed, making it possible to test as many as 4,000 resistors or 2,000 transformers per hour. The range calibration and the zero adjustment are readily performed by means of a built-in standard. The stability of these units is very high and readjustment of the standard controls is generally necessary only once a day.

SPECIFICATIONS

MEASURING OBJECTS FOR DEVIATION MEASUREMENTS	TYPE 1502	TYPE 1507
Resistance	10 Ω-10 MΩ	20 Ω-100 kΩ
Capacitance	50 pF-10 μF	25 pF-0.1 μF
Inductance	2 mH-100 H	100 μH-0.3H
MEASURING OBJECTS FOR DIRECT READING WITH EXTERNAL STANDARDS		
Resistance range from ..	0-0.7 Ω to 0-3.3 MΩ	
Capacitance ranges from .	0-7 pF to 0-3.3 μF	0-7 pF to 33 μF
Measurement Frequency .	1000 c/s	50 kc/s

INSTRUMENT: Large moving-coil instrument and illuminated scale with zero point in the centre. The instrument is safeguarded against overloads. Full scale deflection from — 7% to + 8% on one range, and — 25% to + 35% on the other range.

COMPARISON ACCURACY: Better than 0.1% at zero point.

TOLERANCE ACCURACY: Better than 5% at full scale deflection.

SPEED OF OPERATION: Normal production test is 4,000 resistors or capacitors per hour.

STABILITY: The zero point is independent of the line voltage.

AC-HUM: The bridge is not sensitive to hum voltages.

TUBES: 3x6AU6, 6AQ5, 6X4, OA2, and in Type 1507 also 6AL5.

POWER SUPPLY: 115, 127, 150, 220 volts a.c. 40-120 c/s. 40 watts.

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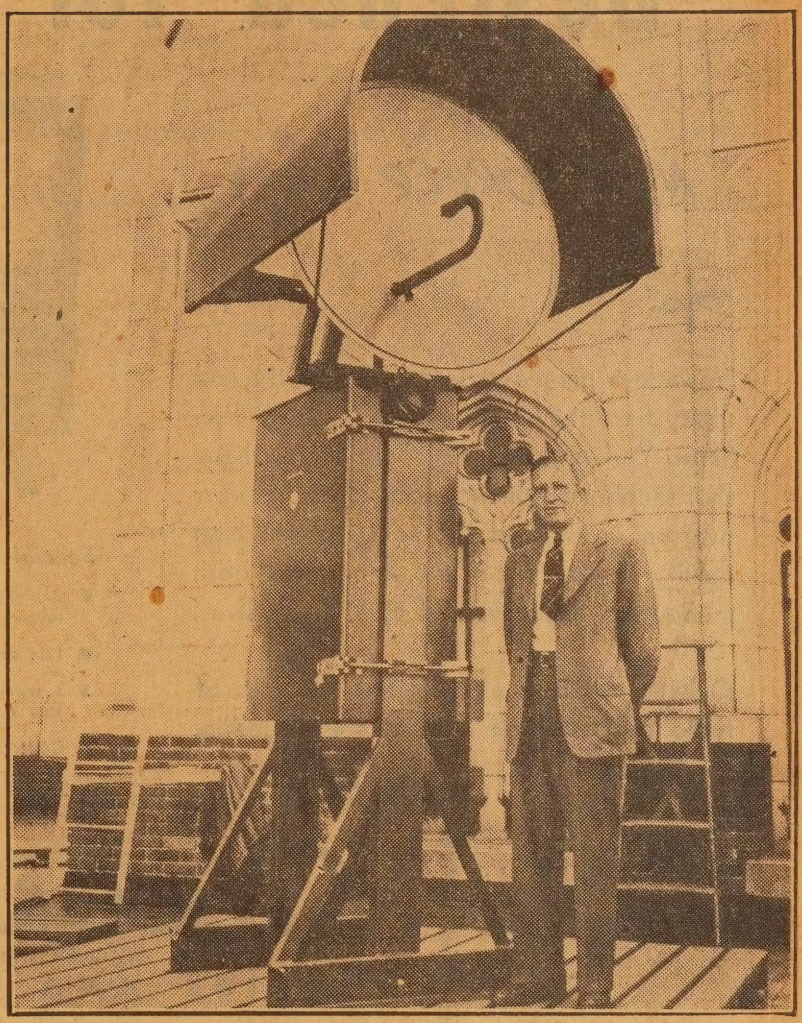
LATEST DESIGN FOR TV RELAYS

This new microwave television relay equipment made by Motorolo, USA, is typical of the latest design for quality transmission of television signals to remote points over distances up to 200 miles. These systems can be used either for stub relay of network broadcasts to remote localities or as "STL" interconnects between centrally located studios and remotely located TV broadcast transmitters.



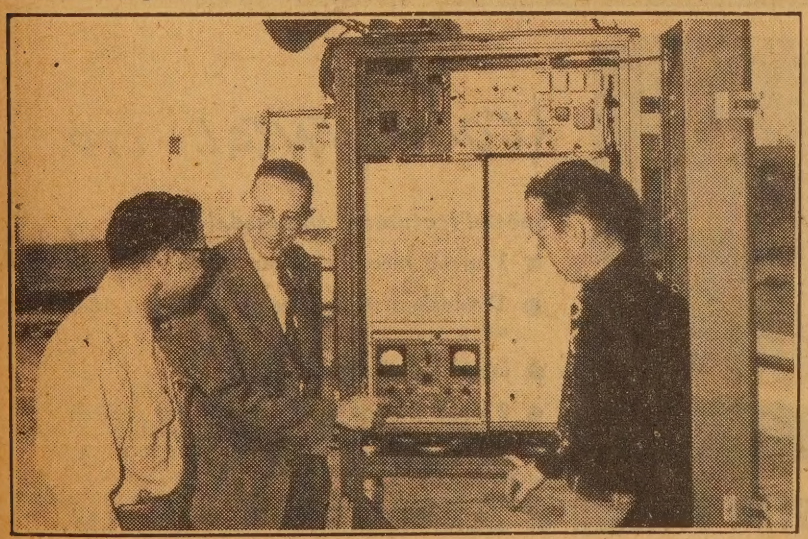
Hubert Sharp, radio engineer for the Mountain States Telephone and Telegraph Company, standing before the microwave TV relay equipment at the company's Denver office. Parabolic reflector beams the microwave energy toward the remote station. The crook-shaped tube is a "waveguide" through which energy is transferred from the equipment and radiated from the reflector.

THE system design, representing a marked technological advance in the TV broadcast industry, is unique in that a single microwave RF channel carries not only the broadcast quality video signal, but also the high fidelity audio program channel plus a two-way voice order wire or cue channel.

This feature simplifies adjustment, expedites maintenance, and facilitates quick, easy, foolproof program switching with all elements of the telecast simultaneously co-ordinated.

Common carrier frequencies of 6415 Mc and 6340 Mc are used in the system. The first is for video-audio-service transmission, and the second for service or cue channel transmission in the return direction. The equipment is also available for operation in the 6875-7125 Mc. "STL" range. These system frequencies are approximately the same as those used in over 5000 miles of industrial point-to-point communications networks throughout the country.

The complete, packaged system with the exception of a rack mounted high fidelity amplifying apparatus at the receiving terminal, is installed in an outdoor weatherproof housing.



Swinging back the "lid" shows equipment stowed in the weatherproof box. It is intended to operate for long periods unattended.

The first of these new microwave TV relay installations was recently completed by the Mountain States Telephone and Telegraph Company in Denver, Colorado. The installation provides an inter-connecting circuit between the radio relay terminated in the telephone company office in Denver and a television broadcast transmitter on top of Lookout Mountain, 14 miles away and some 3000 feet above the "mile-high city".

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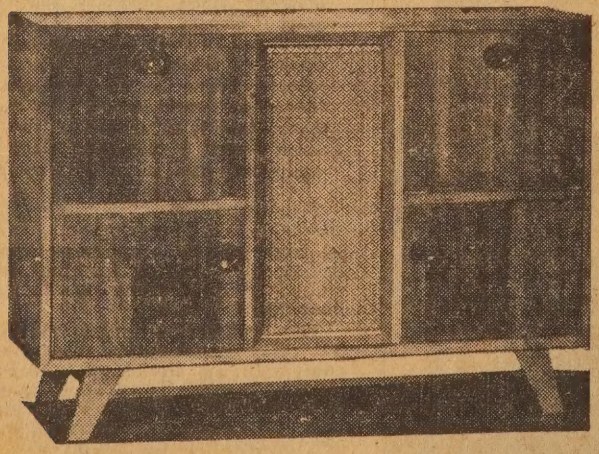

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THE STRUCTURE OF THE EARTH

Although man originated on the earth and has been for ever earthbound, we know more about the constitution of stars that are many millions of miles away than we do about the very earth beneath our feet. That this is so is hardly unexpected when we consider that the deepest hole that man has yet made in the earth is approximately four miles, which is merely a thousandth part of its radius.

By "PHYSICIST"

BECAUSE we are only able to scratch the surface of the earth, most of our knowledge about its interior must, therefore, be obtained indirectly.

But, in this era of ever-expanding industry, the increasing use to which the materials of the earth are being put, inevitably leading to their exhaustion is impelling man to learn more about the inside of the earth in the hope that new reserves might be found therein.

Especially is this true of fuel supplies, and investigations are being actively pursued to determine how heat from inside the earth can be utilised.

SIZE OF THE EARTH

The size of the earth can be determined fairly simply and it is also easy to show that it is approximately a sphere of 4000 miles radius (see Fig. 1). By studying the forces of attraction between the earth and two weights of known mass, it is possible to determine the weight of the earth (Fig. 2) and once the weight and size are known its average density can be calculated.

This has been done many times and the value obtained, viz. 5.5 times that of water, is about twice the density of the rocks which make up the earth's surface. Consequently, it has been argued that the matter inside the earth is much more dense than that on its surface.

To some extent this increase in density is only to be expected, partly because of the very high pressures that exist in the interior of the earth and also because the heavier materials would tend to sink toward the centre, if this has been at any time possible.

It is now almost 200 years since the size and weight of the earth were first calculated, but it is only recently that information about the composition of the inside of the earth has been deduced.

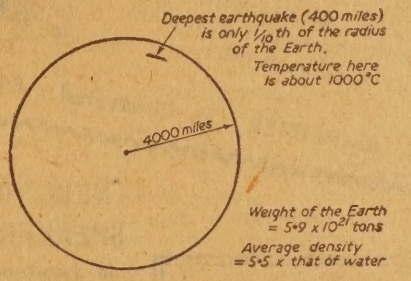
Deepest earthquake (400 miles) is only 1/10th of the radius of the Earth.
Temperature here is about 1000°C
4000 miles
Weight of the Earth = 5·9 x 10^21 tons
Average density = 5·5 x that of water

Fig. 1.—Size and shape of the earth The deepest hole made by man is 4 miles deep, which is 1/1,000 radius of the earth and is merely a scratch in the earth's surface.

Admittedly, attempts have been made from time to time to guess the composition and structure of the earth. Amongst these, Edmund Halley's description in 1692 of the inside of the earth, based almost exclusively on a knowledge of terrestrial magnetism, was particularly outstanding, anticipating in a remarkable way some of the more recent deductions about the earth; but, because this was largely inspired guessing, some of his statements, especially those relating to the inhabitants which Halley suggested might live inside the earth, are far from reality.

EARTH TREMORS

In recent years the study of earthquakes and tremors or, to be more scientifically accurate, the science of seismology, has afforded a much clearer insight of the composition of the earth's interior, for, although the destructiveness of earthquakes is confined to a small region of the earth's surface, the vibrations which accompany them travel in all directions through the earth and can be detected on instruments called seismographs.

From observations made with these instruments at several points on the earth's surface it is possible to map the paths of the vibrations and also to deduce the speed with which they have travelled at all points along their paths (see Fig. 3).

The speed at which vibrations are transmitted in a material is related to its density. Therefore, once the speed with which the vibrations travel at all points of their path is known, the density distribution of the material along the path can be deduced.

VELOCITY

Thus, if the times of arrival of the vibrations from an earthquake be noted at several points on the earth's surface, the velocity of these vibrations along their respective paths through the earth can be calculated, if the relative positions of the observatories and the centre of the earthquake are known.

Mechanical vibrations can be of two kinds: (a) longitudinal, in which the particles of matter vibrate along the line of propagation of the vibration, and (b) transverse, in which the particles of matter vibrate in directions perpendicular to the line of propagation. Solids are able to transmit both types of vibrations, but, in liquids, only longitudinal vibrations are transmitted.

(Continued on Page 11)

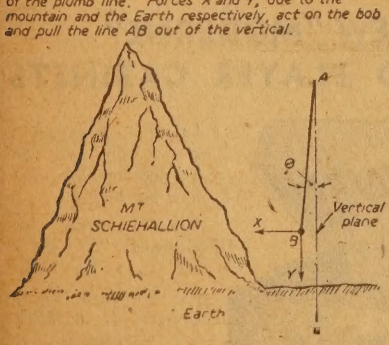
Two masses, one the mountain and the other the bob of the plumb line. Forces X and Y, due to the mountain and the Earth respectively, act on the bob and pull the line AB out of the vertical.
MT SCHIEHALLION
A
B
θ
X
Y
Vertical plane
Earth

Fig. 2.—One of the first experiments to determine the weight of the earth, made by Maskelyne near Mount Schiehallion, in Scotland. The extent to which the plumb line AB was pulled out of the vertical by the attractive force X of the matter in the mountain was measure. The weight of the mountain was deduced as accurately as possible by survey and the weight of the earth was thus obtained. More accurate methods have since been evolved.

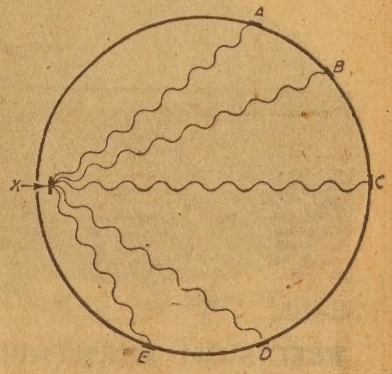

Fig. 3.—Vibrations from earthquake at X travel through the earth as shown and can be detected on seismographs at A, B, C, D and E. From a knowledge of the location of the earthquake, with respect to the receiving stations and the time taken for the vibrations to travel along their respective paths through the earth, it is possible to deduce the density of the material through which they have travelled.

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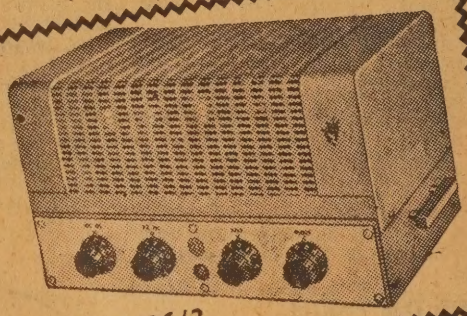

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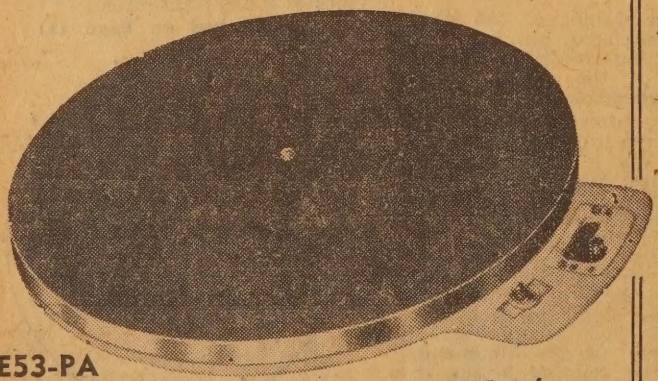

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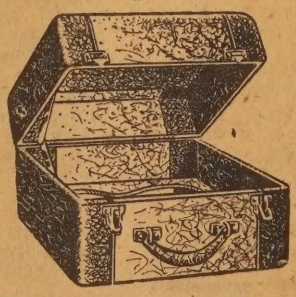

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The groups of vibrations from earthquakes which travel through the earth and are detected by seismographs, are of a very complex nature.

It is found that according to the direction in which they have travelled through the earth they may be a combination of both longitudinal and transverse vibrations or longitudinal vibrations alone, and that the longitudinal vibrations have travelled along paths deepest in the earth. These observations are consistent with the hypothesis that the earth has a central region which is liquid and has a high density. It has been commonly accepted that this liquid core is a molten metal and most investigators are agreed that it is probably iron.

IRON CORE?

In addition to molten iron having the right density, there is some indirect evidence to support this deduction. Iron is quite a common material in the universe. Meteorites are mainly iron and are believed to be the fragments of matter from the same parent star as the earth and the other planets

The radius of this core of liquid matter, whose density is roughly twice that of the surrounding material, is approximately 2000 miles and there are some indications that its boundary is quite sharp. Surrounding this core and extending to the surface, is a shell of solid rock-like material whose density decreases toward the surface (Fig. 4a).

Seismic studies show that the actual origin of earthquakes is usually very near to the earth's surface and is never deeper than 300 to 400 miles. That this is so has been taken to indicate that below this depth the material is not truly solid, but behaves as a stiff paste or dough. Hence, it is argued that the transition from the liquid core to the solid shell is not nearly so sharp as other seismograph evidence might indicate.

EFFECT OF PRESSURE

Some investigators have pointed out that the high pressures which exist inside the earth might compress rock-like material and greatly increase its density. At the same time the pressure may profoundly alter the physical characteristics of this material, giving it the properties of a metal. It is therefore suggested by these investigators that the chemical compositions of the earth is everywhere the same.

Unfortunately, our knowledge of the transformations of matter that occur at high pressures is not sufficient for us to decide whether the above hypothesis is correct, but Bridgeman, at Harvard, who for many years has pioneered high pressure investigations, has succeeded in changing the soft, spongy element, phosphorus, into a black metallic form at extremely high pressures.

It is generally agreed that the earth was originally molten, and it has recently been shown that, if this were so, there must inevitably be a solid core within the molten centre of the earth, but there is no direct experimental evidence to confirm this (see Fig. 4b).

That the temperature of the earth increases from its surface inward has been known for a long time. At a depth of 12,000ft the temperature is higher than the boiling point of water; and that the temperature continues to increase at greater depths is borne out in volcanic eruptions, where the temperature of the lava sometimes exceeds 1000 deg. C.

Attempts are being made in France to utilise terrestrial heat. It is proposed to sink a shaft 10in in diameter to a depth of 13,000ft which would bring a mixture of water and steam to the surface at a temperature above 100deg C. and at a rate of 140lb per second. There are hopes that sufficient heat could be obtained from a system of shafts to supply a power-station.

Another means of extracting useful heat from the earth is possibly the heat pump, which functions on the same principle as the refrigerator and extracts heat from a low temperature source and gives it out to a higher temperature region.

We have no real knowledge of the temperatures that exist at depths greater than a few hundred miles. Some values have been deduced from theories of the origin of the earth but, apart from knowing that it must be sufficiently high to keep the core molten and yet not so high as to melt the surrounding rock, it cannot be fixed with any degree of certainty. Typical estimates vary from 1000 to 10,000 deg. C.

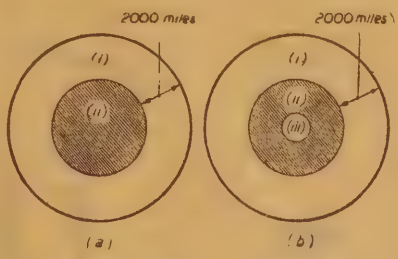

Fig. 4.—The structure of the earth. (a) Based solely on evidence from seismographical studies. (i) Solid shell of rock - like material, approximately 2,000 miles thick and from 2.5 to 5 times as dense as water. (ii) Core of molten material probably iron, from 5 to 12 times as dense as water. (b) Modified structure, taking into account evidence suggested from possible origin of the earth. (i) Solid shell of rock-like material. (ii) Shell of molten material, probaly iron. (iii) Core of solid material, probably metallic, about 12 times as dense as water. NOTE:—Although some seismographic data suggests that the division between the liquid core and the solid shell is quite sharp, other evidence indicates that the transition is gradual and that there is quite a large region of plastic matter.

Magnetic effects are observed at all points on the earth's surface, but they vary in intensity over the surface. Even at one point they do not remain constant, varying continually with time. Most of the variations that occur can be ascribed to the influence of the sun and the moon, in the main being due to ionising radiations from the sun.

There is, however, one variation, viz, the variation in the direction of the magnetic field, which must be due to some change occurring within the earth. The effect is cyclic with a periodicity of approximately 700 years.

MAGNET CONCEPT

In 1600 Gilbert suggested that the earth was a magnet, and in 1692 Halley elaborated the concept by postulating that the earth contained an inner solid core of magnetic material with liquid between it and the crust. Halley suggested that the north and south magnetic poles of the earth were situated on the crust and a further two poles were located on the solid inner core.

Because of the liquid layer, the rotational motion of the outer solid crust was not fully imparted to the core and, as a result, this cyclic variation in the direction of the magnetic field was produced (Fig. 5).

There are, however, serious objections to this, or any other hypothesis which requires the material in the interior of the earth to exhibit strong magnetic properties, for it is a well-established experimental fact that these strong (ferro-) magnetic properties are destroyed in all known metals and compounds at temperatures well below those which exist inside the earth.

To meet this objection it has been suggested that the earth's magnetic field might be due to a system of electric currents which flow in the interior of the earth, but unless these were continually maintained they would gradually decay, due to the electrical resistance of the core

Unfortunately, we have little knowledge of the resistance of metals at very high temperatures and pressures, so that we have no means of deducing the rate at which these currents might be expected to decay. There is some indication from records of terrestrial magnetism, which have been kept now for over 100 years, that there is a very small decrease in the strength of the earth's magnetic field, but this is really too

(Continued on Page 41)

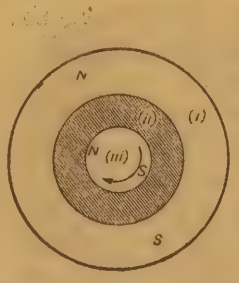

Fig. 5.—Structure of the earth suggested by Edmund Halley in 1692 to account for changes in the earth's magnetic field. (i) Outer solid shell having fixed N and S magnetic poles. (ii) Liquid region. (iii) Inner solid core again having fixed magnetic poles, but rotating with respect to outer shell.

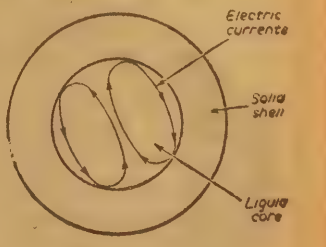

Fig. 6.—(Right).—Diagrammatic representation of electric currents in the molten core of the earth. These are possibly maintained by convection currents in the molten metal.

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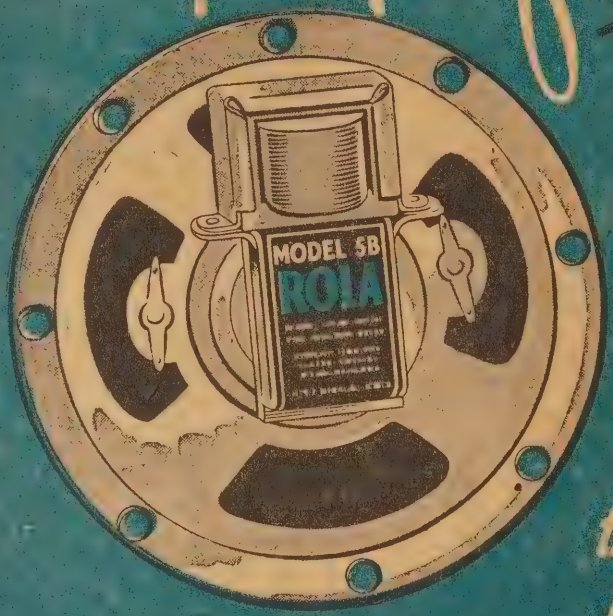

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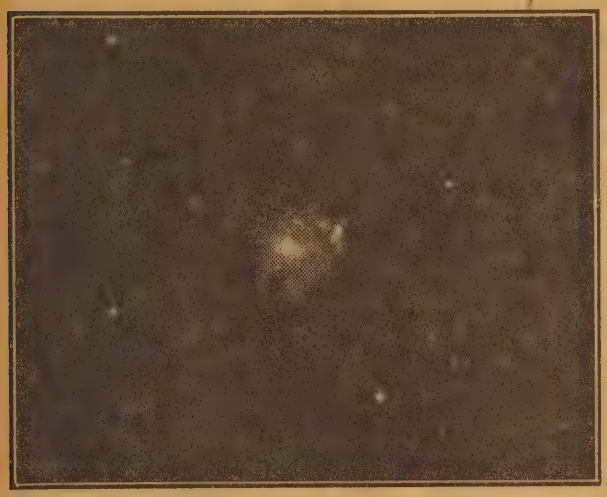


Spiral Galaxy NGC 5668 photographed at Palomar before the explosion.

This picture taken in May shows the bright supernova. It happened 20 million years ago!

It has taken 20,000,000 years for light to reach the earth from an enormous stellar explosion discovered last May 4 by a young astrophysics student and researchist at the California Institute of Technology.

AND light travels 186,000 miles a second.

The exploding star, or supernova, occurred while the mastodons on earth were still relatively small creatures. When our earliest human ancestors appeared, the light message speeding through space was still several million, million, million miles distant.

Photographs show for the first time the tremendous blast discovered by 29-year-old Paul Wild, with the 18in Schmidt telescope at the Mt. Palomar Observatory—an explosion roughly calculated to be 10,000,000,000,000 , 000 , 000 , 000 , 000 times more violent than the H-bomb.

It occured in the vast swirling aggregation of stars known as NGC 5668, a spiral galaxy that apparently is hurtling away from earth at about 1000 miles a second.

TITANIC BLAST

California Institute of Technology spokesmen said light from the star explosion intercepted by Wild indicated the titanic blast was about a week or 10 days past its peak when discovered, and added that the outburst apparently occurred on the far side of NGC 5668, with current observations being made through all the intervening gas and dust of that galaxy as well as our own.

They calculate that it was eons before primitive man first noticed the stars that the explosion occurred with a brightness some few hundred million times brighter than our sun.

From a systematic search of supernovae made in the 1950s, it was estimated that in the average galaxy, an exceptionally bright (exploding) star appears—where none had been observed before—only once every 200 years or so.

The new supernova discovered by the young Swiss research assistant on a special photographic plate was the first found by the Palomar Observatory in any galaxy since March 20, 1950, when Dr. Milton L. Humason found an exploding star in the galaxy known as IC 4051 in the constellation of Coma Berenices.

No supernovae have been found in our own galaxy, the Milky Way, since 1604, when "Kepler's nova", observed by Johannes Kepler, appeared as bright as the planet Jupiter for some weeks and remained visible for almost two years.

"Tycho's star", which appeared in 1572, was visible to "persons gifted with good sight" at daylight, even at noon when the sky was clear, according to the report of its discoverer, Tycho Brahe.

California Institute of Technology scientists added that the first supernova known in our galaxy was observed in 1054 by Chinese who called it "chich'ou" or "guest star".

An 18in Schmidt exposure made three years ago of NGC 5668 in the constellation of Virgo showed no stars visible and because of its great distance the galaxy was merely a blurred area on the film.

ROCKET MODELS HELP DESIGNERS

Small rocket-propelled aircraft, similar to those flown by model aircraft enthusiasts, are helping British designers to plan the shapes of the flying-boats and water-based fighters of the future.

THE models are powered by small rocket-motors which give up to 10lb of thrust—less than 1 pc of the thrust given by a full-size jet. The models are launched on to the water and their performance recorded on film.

Hundreds of tests have been made with these self-propelled models in tanks, at sea, and on rivers and lakes.

In the past, designers investigating the behavior of flying-boats on water usually tested them by building solid models which were catapulted into indoor tanks.

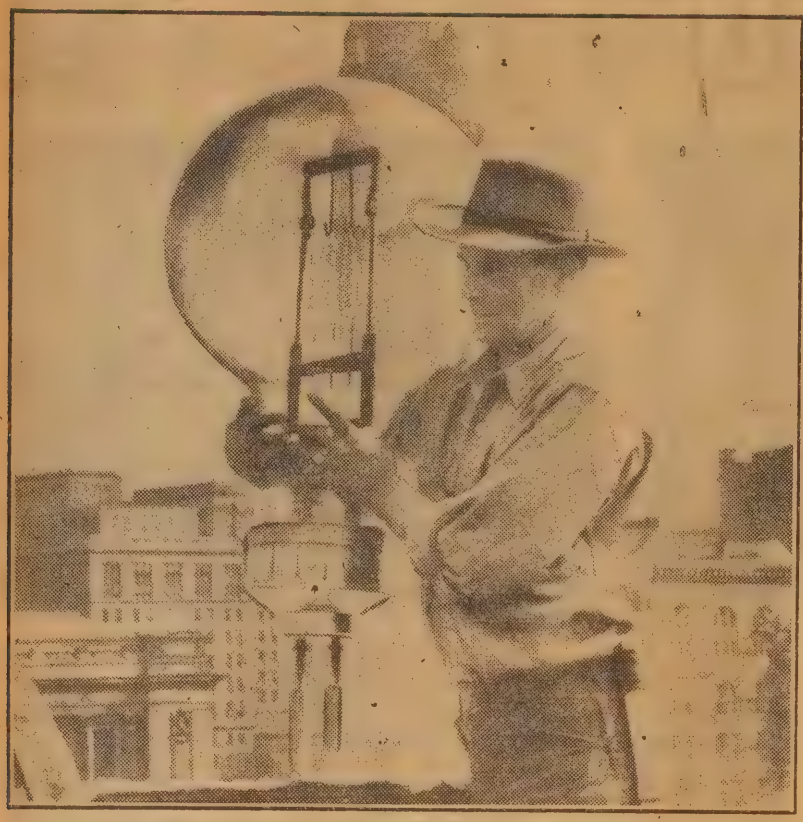
However, it has now been found that some of the intricate data required cannot be obtained with these catapulted models and the more complex self-propelled type is needed.

An example is a flying-boat's performance when taking off across large waves. It will be accelerating, but the acceleration will not be constant, because as it hits each wave, the plane will tend to slow down. Here, therefore, it is essential to use a model which can taxi under its own power.

The models are usually built of wood. Sometimes they are powered by small compression ignition engines driving propellers, but usually rocket motors are fitted because of their greater reliability.

The rocket's fuel is hydrogen peroxide. The motor is very robust and on one occasion, after a model had accidentally dived into the water, the motor continued to propel the aircraft along quite happily below the surface.

Over short ranges, the models are guided by radio control. The miniature receivers carried in the aircraft are small enough to be held in the palm of the hand.



A huge incandescent lamp of 160,000-candle power as used for special lighting purposes.

THE MIRACLE OF MODERN LIGHT

The story of modern lighting is a fascinating one, and it is hard to imagine that for so long man was obliged to use such primitive methods. Nowadays electricity has provided light sources suitable for every conceivable use and new types are continually being developed.

IT is difficult to envisage any single factor with an application to human existence as broad as that of artificial light.

There was a time according to Bible history when the earth was encompassed in darkness. There surely could not have been anything living on it at that time, for perpetual darkness is inimical to the growth of any living thing—unless one excludes mushrooms.

When man came on the earth there was, of course, the sun to shine by day and the moon to shine by night, so that even by moonlight man had a reasonable chance of carrying out his activities, whatever they may have been in those days.

WORK AT NIGHT

Later in history man decided that he wanted to carry out full daytime activities at night.

This yearning excluded, of course, those individuals whose professions ran along the lines of burglary, arson, elopement, and other nefarious activities. Even at the present time, light is a curse to such people, so that we can dismiss them from our thoughts right now.

To the other class of people, light became a necessity, if only as protection against the above-mentioned, ill-disposed persons. Even a burning faggot in a cave was sufficient for a man to keep his eye on his wife, as well as affording protection against the savage animals, which roamed the countryside in those days. Better a burning faggot than to be swallowed by a dinosaur.

So early man with his burning faggots laid the foundations of the lighting industry, from primitive torches to fluorescent lighting, for as soon as he had experienced the benefits of artificial light, he developed the art in a great variety of ways.

His first discovery was the fact that burning fat gave out an appreciable amount of light. He probably noticed this when he was cooking one of his neighbor's shoulder blades over the camp fire.

It was quite a simple matter then to collect the fat in some receptacle, such as the top of his neighbor's skull, and insert a piece of vegetable fibre. Thus we had the first oil lamp.

In various shapes it served a purpose for thousands of years as the only form of illumination. These variations took the form of different wicks and more elaborate containers. They were all smelly things, and gave out more heat than light until Argand, in 1784, brought out his new burner, which admitted air in a proper mixture of oil vapor and obtained the smokeless flame.

OIL LAMP

This was the lamp still in use in Sydney up to the summer of 1953 at which time the electricity supply began to improve.

The lamp consisted of a glass chimney around a hollow wick to which air was admitted, thus giving a correct mixture of air and oil vapor to produce a bright, smokeless flame.

Candles were an early source of light, and the Phoenicians reputedly sold candles in Byzantium in the fourth century AD. These were made of bleached wax with fibre wicks. Such candles were also rather messy, for the wax melted quicker than the wick burnt away. As a result, the latter was always falling over into the molten wax. This created a surplus of molten wax and the candle did not last long.

COAL GAS

In addition to this, the wax was always falling on to the carpet. Or it would have done if they had any carpets. In any case it made a mess over whatever they had in those days.

The problem was partly solved in 1840 with the introduction of plaited wicks and the use of sperm oil for making the candle.

Things didn't make much headway until the discovery of petroleum about the middle of the nineteenth century. This stimulated things quite a bit, as the higher volatility of petroleum made it possible to use the incandescent mantle developed by Welsbach in about 1885.

In 1779 Murdoch experimented

by Calvin Walters

with the use of coal gas for illumination, but because the gas then used was not pure enough, progress with this was delayed for a long time until Welsbach introduced his mantle.

The advent of better gas supplies gave a tremendous impetus to the use of gas for lighting. This was the ultimate for very many years until the discovery of electricity generation by Faraday in 1831, a discovery which gave birth to the electrical industry of modern times.

From 1849 arc lights were in use for various special purposes. The fact that an electric current will heat up a conductor stimulated the minds of many experimenters in order to produce an electric lamp.

POOR VACUUM

Because a high vacuum could not be obtained with the vacuum pumps known at that time all the various lamps tried had a very short life because the hot filaments quickly burnt out in the presence of oxygen.

In 1875, however, the introduction of a very efficient air pump by Sprengel gave a tremendous boost to the development of the electric lamp.

All kinds of material were tried for the filaments. Platinum, carbonised paper, carbonised cellulose fibre.

Edison made the most satisfactory lamp of this kind with a filament of carbonised bamboo.

Carbon filaments served the purpose until the advent of the tungsten filament in 1906, the year which marks the beginning of the modern era in electric lamp manufacture.

The disadvantage of carbon filaments was that they generated a tremendous amount of heat for the small amount of light given. They also aged and eventually deposited a black coating on the inside of the glass bulb.

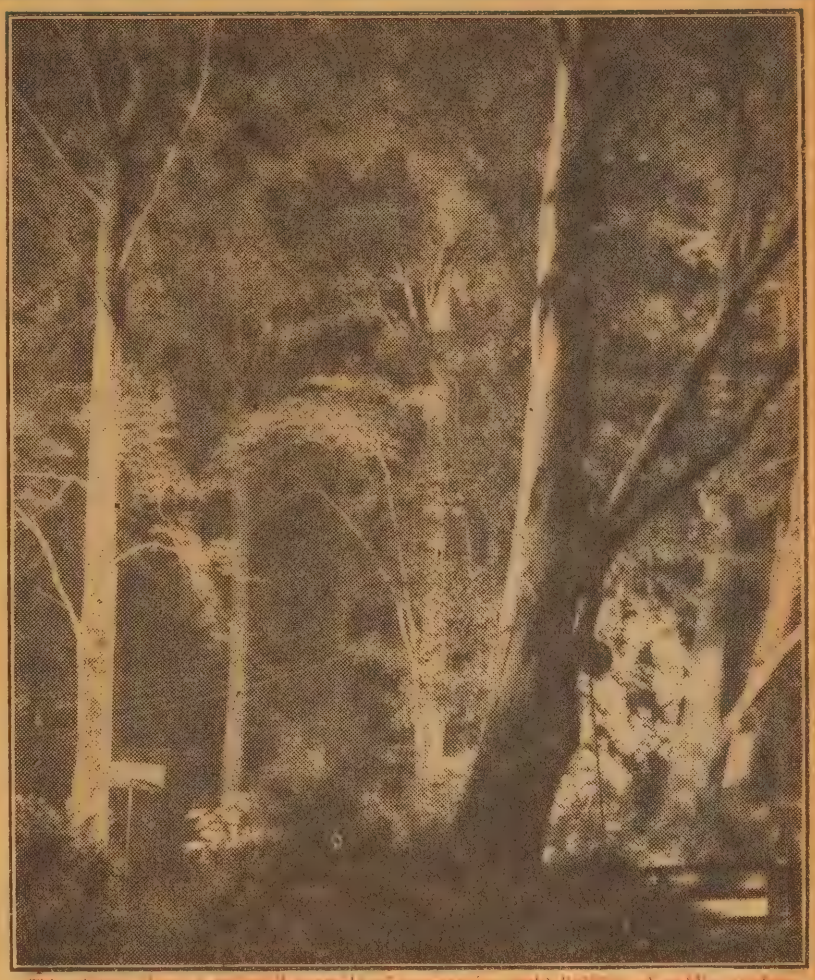
It was realised that if a metal could be found which could withstand a great amount of heat without melting it could be brought to a high degree of incandescence. Tungsten was that metal, but there was one great difficulty. It could not be drawn into very fine wire without breaking.

TUNGSTEN FILAMENTS

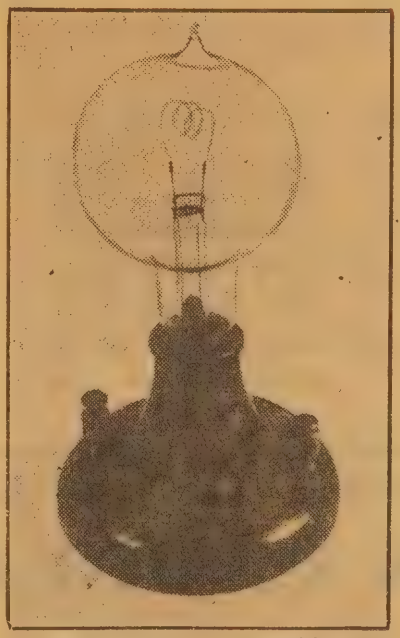
Tungsten is produced from an ore called wolfram, and is in the form of a fine grey metallic powder over 99.9 pc pure. No means had been found up to 1909 of making this powder cohere so that a fine filament could not be made.

In 1909 a method was discovered which changed the course of electric lamp manufacture.

The tungsten powder in a mould about 16in by 3-8in square is subjected to very high pressure by a hydraulic press. This causes the powder to cohere sufficiently to permit of careful handling. The bar is then treated with a very high electric current in an atmosphere of hydrogen which causes the particles of metal to adhere together in a solid bar. This process is called sintering. The sintered bar is placed in a furnace and when hot is beaten with hammers until it becomes thinner and longer. This process is called swaging.



This picture shows a splendid example of spectacular night lighting at public gardens. Colors are selected to suit the individual trees and shrubs.



A model of the first successful incandescent bulb developed by Thomas Edison.

The swaging process is continued until the bar is thin enough to be handled in wire drawing machinery.

The metal is then drawn through diamond dies until it is of the required diameter for the filament.

At the end of this process the original 16in long bar has been extended to a length of several miles.

As this filament is the heart of an electric lamp it is worth while to go into the matter in greater detail.

Lamp filaments must be made with extreme accuracy.

The filaments consist of a coil of tungsten wire either in a single coil or a coiled coil. We will deal with this more fully later.

As it must withstand temperatures greater than 2500 degrees centigrade it must be strong enough to remain strong and rigid at these temperatures.

The size of the grains of the powdered tungsten must be maintained between one and two thousandths of a millimetre in diameter. If the smaller sizes predominate the wire will be unsatisfactory. Each batch of powder is therefore measured, and the distribution of various sizes determined. This is done with photomicrography and projection on to a screen.

For most of the lamps in use today the diameter of the wire ranges

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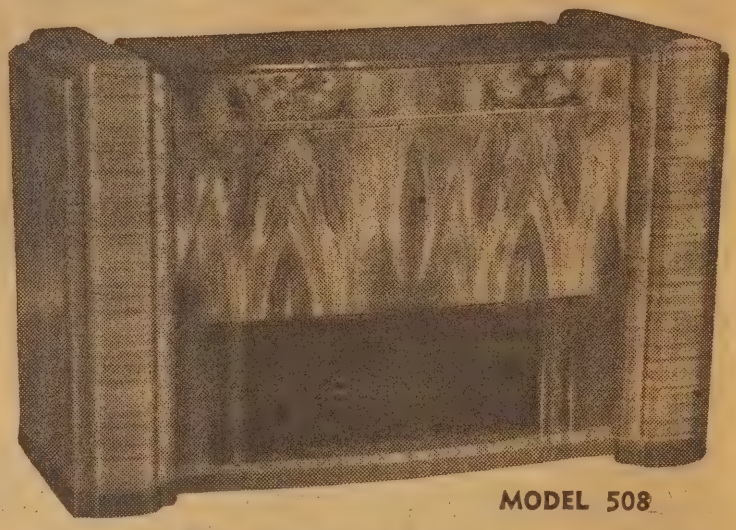

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from .0006 to .002 inches in diameter, and this measurement must not exceed at any one point a variation of more than one pc.

That is ten one millionths of an inch. The dies used for drawing the wire must always be kept perfectly round and with a size tolerance of not greater than 2 pc.

WINDING FILAMENT

As the wire comes from the dies it is wound on a metal wire called a mandrel. The filament comes off the mandrel in the form of a very closely wound spring. The internal diameter of this spring must be very accurately controlled as is also the distance between each coil. Any variation in these will cause non uniformity in the brightness of the filament because of variation of resistance and heat will radiate more quickly from those coils which are furthest away from their neighbors.

The most important reason is that the length of wire in the filament is predetermined to a certain resistance in order to consume the current to produce the required brightness. If the coils of the filament are further apart than previously determined or if the internal diameter is less, then obviously the filament will be actually shorter than required and the lamp will have a very short life. The converse is that the filament will be too long and will not give the amount of light estimated.

According to the wattage of the lamp, the distance between the coils varies from 0.3 to 0.6 of the wire diameter, and the permissible variation is only 1 per cent or about 5 millionths of an inch for a 40 watt lamp.

COILED COILS

Coiled coil filaments are made by winding the original coil round another mandrel. In both the single coil and the coiled coil filaments the mandrel is removed by dissolving in acid after the filament has been cut into the required lengths.

The extreme accuracy of the process will be appreciated when it is considered that although the turns of the coiled coil filament are far too small to be distinguished with the unaided eye, any minute displacement, which can only be seen microscopically, but which might enable one turn to touch the next, will cause a serious loss in the life of the lamp. These defects must be avoided and it is a tribute to human ingenuity that machines can be made to produce lamps with such a high degree of accuracy.

Before and after the mandrel and filament are cut to length they are treated in the presence of hydrogen at a temperature of up to 1800 degrees centigrade. This treatment prevents excessive sag of the filament during the life of the lamp.

GLASS MOULDING

The filament is therefore the heart of the electric lamp. From this stage on it is a matter of assembly.

The glass envelope of the lamp is made in an automatic machine which is capable of making 100,000 globes a day. In this machine a drop of glass — which by the way is a high grade product — is fed into carbon lined iron moulds and air blown into the mould.

This air blows the glass into the shape of the mould which revolves round the outside of the glass. This revolving process prevents the formation of a ridge where the two halves of the mould meet.

The bulbs are then annealed and if they are to be pearl lamps they are sprayed internally with two coats of hydro-fluoric acid, which etches the glass on the inside.

The stem of the lamp through which the lead in wires protrude is made separately. This stem is in the form of a tube. The molybdenum supports for the filaments are inserted into the stem whilst in a molten state. The wires are inserted into the "pinch" at the base of the stem which is then softened and pressed together, thus making an airtight joint.

The filaments are fixed onto the supports and the whole assembly inserted through the neck of the bulb and welded to it by a flame which melts the glass together as the bulb revolves.

Before insertion the filament is dipped into a solution containing phosphorus.

The bulb is now exhausted of air by connecting the pump to the small glass pip seen at the base of the glass. The air is removed to an extent which produces bulb pressures of only one hundred thousandth of a millimetre of mercury.

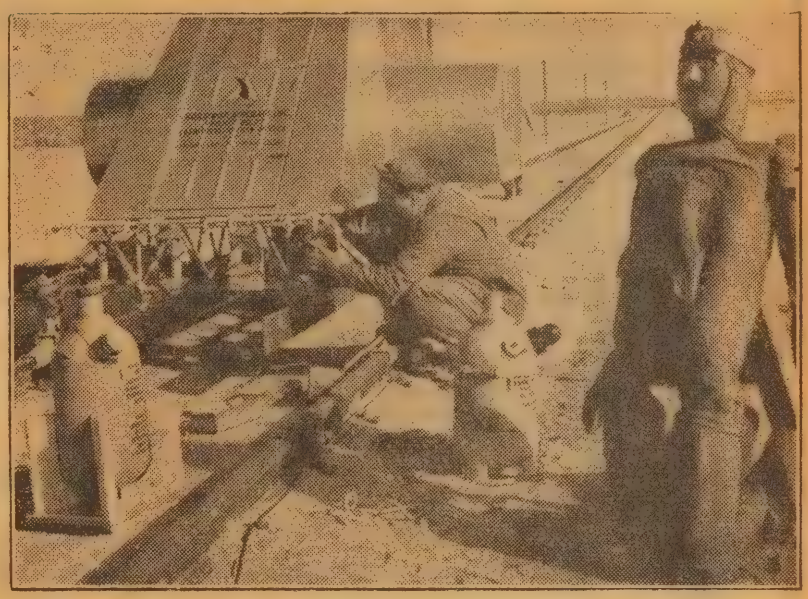
ABSORBS OXYGEN

If the lamp is to be gas filled it is filled with a mixture of argon and nitrogen. The lamp is now sealed off and an electric current applied to the filament. This ignites the phosphorus in which the filament has been dipped and burns off any remaining oxygen.

Finally the base of the lamp is cemented on after soldering the lead in wires into position.

This latter portion of my discourse is of necessity incomplete and sketchy because of considerations of space, but it gives a fair idea of the process. The main feature of this article is the heart of the lamp—the filament. Much more can be said about it, the use of gas in the lamps, the effects of gas pressures, the manufacture of the glass for the bulbs, colors, fluorescence and so on.

TOYS HELP SCIENCE SAVE LIFE



Deceleration tests are made with this toy man.

Toys have been harnessed to science. They have been made to reveal facts of design and to predict performance. They provide scientists with reliable data at a minimum of cost. In some ways they are shaping our future.

SUCH "toys" have been used where a hazard to life is involved. A bleeding dummy man is the US Navy's latest artifice that can help First Aid students learn the elements of life saving.

Another dummy man, based on measurements taken of 1200 British airmen, has been built to show what happens to an unconscious pilot who has bailed out of his high-flying supersonic plane. The dummy's "bones" snap at the proper pressures and he tumbles through the air at true-to-life speeds before his parachute opens. His checkered suit makes him easy to spot through field glasses as he plunges to his possible "death". But as a result of his trials, more safety is seeping into the Royal Air Force.

Complete with moustache, the propped-up dummy, shown above has helped Northrop Aircraft engineers with deceleration experiments conducted for the Air Force.

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Technical Review

AUTOMATIC LINE DRAWINGS FROM PHOTOGRAPHS

There are many phases of science, medicine, and industry where line drawings have to be prepared from photographic records in order to enhance the essential detail. Previously a laborious hand operation, it may soon become an almost completely automatic process by means of a device developed by the National Bureau of Standards in the US.

THE bureau has recently constructed an experimental optico-electronic system that will facilitate the study of visual perception and recognition of patterns, and also promises to have a number of useful engineering applications.

This device can clarify blurred images or produce outline pictures or line drawings from half-tone photographs. Other possible applications include automatic recognition of patterns such as fingerprints or biological specimens.

The system operates on patterns in the form of photographic transparencies placed in an optical assembly between a cathode ray tube with a moving spot and a photo-multiplier tube. The signals resulting from scanning the picture are amplified and fed back to the intensity control grid of the cathode ray tube, and thus produce a negative image on its screen.

This process amounts to a form of optical negative feedback, which can be electrically controlled and used to improve greatly the tonal rendition of the picture. The same signals are also applied to another amplifier and the resulting signal is used to control a monitor cathode ray tube, which reproduces the same picture. It is from this screen that the new and improved picture is ultimately made.

SCANNING SYSTEM

Although any scanning system can be used, such as that employed in television circuits, a much simpler system is possible when both scanning and viewing tubes can be operated from the same source of scanning signals.

This system employs two frequencies, similar, but not identical, which are applied to the horizontal and vertical plates. This produces a continually and rapidly changing Lissajous figure, and, if the rate of change is fast enough, the pattern produced on the screen will be that of a completely illuminated rectangle.

While this effect can be obtained using sine waves, it appears that a more complete scanning for a given frequency is provided by using distorted waves and a triangular waveform is used instead.

As previously mentioned, it is possible to improve the definition of the picture by introducing various correcting circuits between the output of the phototube and the monitor cathode ray tube. This is really the heart of the entire system.

In any video system a rapid transition from black to white, as represented by a sharp outline, calls for a good high frequency response if it is to be faithfully portrayed, and anything which tends to worsen this frequency response will degrade the detail of the picture.

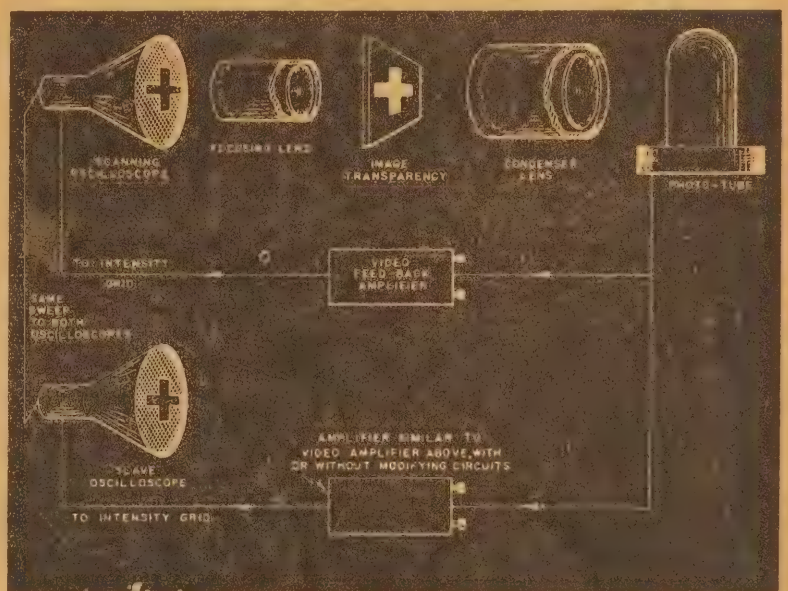
On the other hand, anything which tends to improve the high frequency response will improve the sharpness of the outlines.

This is the method used in this case, the amplifier being capable of considerable high frequency boost, the exact amount being under the control of the operator. This flexibility is one of the highlights of the scheme.

Even more interesting, perhaps, is the ability of the device to produce the equivalent of a line drawing from an ordinary photograph. This is achieved by filtering the signals so that only the high frequencies, representing the sharpest outlines, are left, then rectifying these to produce a positive pulse on the monitor tube control grid.

As a result, the face of the tube is dark until a part of the circuit is scanned which contains a sharp outline. A positive pulse is then applied to the grid of the tube, producing a small spot of light. The image thus produced is a white line drawing on a black background.

Many interesting practical applications are suggested for this facility, varying from the production of sketch maps from aerial photographs to the display of contours of x-ray images.



A simplified drawing of the image processing device. The upper cathode ray tube scans the image which is seen by the photo-tube on the right. The lower cathode ray tube produce the image, either much improved or as a line drawing, according to the adjustment of the amplifier.

THE *Advance* SIGNAL GENERATOR

TYPE P1

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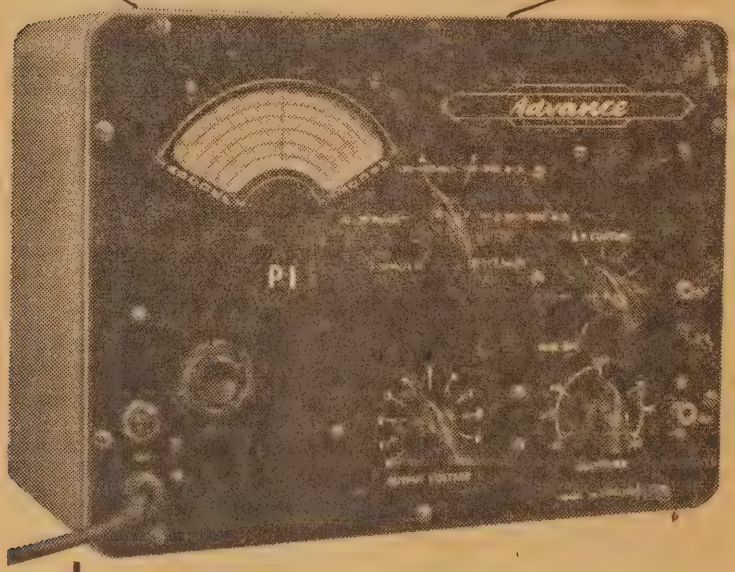

This latest addition to the famous Advance range puts into the hands of every radio and television service engineer a high-grade instrument with an accuracy out of all proportion to its modest price. This has only been achieved by very careful design—employing accepted standard signal generator technique—and by streamlined production methods.

Up-to-the-minute design of the oscillatory circuit and special attention to screening and filtering ensure that, even at 100Mc/s stray field is less than 3 microvolts.

The P1 employs an accurate attenuator system which embodies a non-inductive slide-wire followed by a five-position 75-ohm ladder network. The 75-ohm cable, correctly terminated by the 'Advance' TP8 pad, obviates reflections due to mis-match and ensures that the output voltage at the dummy aerial is substantially that indicated by the attenuators.

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PARAMOUNT ANNOUNCES NEW FILMING PROCESS

Out of all the recent ballyhoo and hubble-bubble in the motion picture industry regarding 3D, semi wide screens—in varying proportions—and ultra wide screens, there now appears to be emerging some hope of border and standardisation. At least the field appears to have been narrowed to two systems which, presumably, will fight it out between them.

THIS has been brought about by Paramount's recent announcement of their new baby, VistaVision. Technical literature recently released by this company explains all aspects of the system and lists the various advantages claimed for it.

One of the most interesting aspects of the matter is that many large interests appear to be backing the scheme. In the US Paramount claim that MGM, Warner Bros., and others are seriously considering this system as a possible standard, while England's J. Arthur Rank—who owns nearly three-quarters of Britain's cinemas—has recently announced that he intends to make all films in this medium as soon as possible.

It is noteworthy that our own published reactions to the various early schemes appear to be supported by Paramount, who claim that the 2.55/1 aspect ratio of CinemaScope is too great, often making it difficult to fill the screen with appropriate action and severely restricting the headroom.

In the matter of stereophonic sound they are also treading warily, pointing out (as we did recently) that such schemes introduce a lot of complication when it comes to matching the various angle shots of the one scene.

PERSPECTA-SOUND

Because of this they are planning to provide the relatively low cost and compatible system, "Perspecta-Sound," for those who feel they must have stereophonic sound, pointing out that the same track will play through any standard projector.

On the purely optical side, however, the emphasis is on VistaVision and the advantages it offers.

Fundamentally, VistaVision differs from all other systems by being photographed, initially, on a much larger negative than has been the custom. Paramount achieved this without recourse to non-standard film stock by the simple procedure of passing the film horizontally through the camera and taking a double-frame picture.

This image is eight sprocket holes long (the same as the standard 35mm still camera negative), and has the same aspect ratio as the old standard motion picture image of 1.33 to 1. The important point, however, is that this negative has about two and a half times the area of the conventional negative. (There is no sound track on the film at this stage.)

Since it is in the original negative that most of the grain and loss of detail occurs, due to the use of high sensitivity, coarse grained emulsions, there is an immediate worthwhile improvement in image quality at this stage. This image is then optically reduced to produce a standard frame, but the improved quality is retained because this and subsequent processing is on low-sensitivity fine-grained stock.

The net result is a release print having a much higher definition than has so far been possible, and Paramount have set out to exploit this feature to the full.

First—and probably most important—they point out that their release print will not differ, apart from quality, from any other standard print. It has a standard aspect ratio of 1.33/1 and carries a Perspecta-Sound optical sound track, which may be played as either a stereophonic or "straight" track, according to the theatre's equipment.

This means that any theatre, whether it be the City De Luxe or the Bullamakanka Mechanics' Institute, can screen the same release print without the need for any additional equipment. Further, they will obtain immediate benefit from the higher quality print in the form of a sharper projected image. In short, something for nothing.

But, say Paramount, this is only the beginning. Those who may want to do so can really "go to town" on the aspect ratio by cropping the top and bottom of the picture with modified aperture plate in the projector.

This has been the custom with many large theatres for some time now, standard release prints with the 1.33/1 aspect ratio having been shown through aperture plates, giving them an aspect ratio of from 1.6/1 to 1.85/1. The obvious difficulties have been the "butchering" of some scenes in early prints by careless framing, and the increased grain and poorer definition caused by the additional enlargement.

The framing problem has been minimised by the provision of greater head room when shooting the scenes, but the problem of grain and definition has remained until the advent of VistaVision.

The improved definition now makes it possible to crop the picture down to an aspect ratio of 2/1 if so desired, and the scenes are shot with this possibility in mind. At the same time Paramount recommends an aspect ratio of 1.85/1 as being the ideal and are hoping that this may eventually find general acceptance in the trade.

As well as cropping the picture to produce the desired aspect ratio, it is also recommended that the screen be made as large as can be conveniently accommodated in the theatre, since it is claimed that the improved definition makes this possible without any loss of detail for the front row patrons and with obvious advantages in the rest of the house.

Paramount also intend to make available special release prints which have been "squeezed" (in a manner similar to CinemaScope, though to a lesser degree) for those theatres which are equippped to show them. These will compress a

(Continued on Page 49)

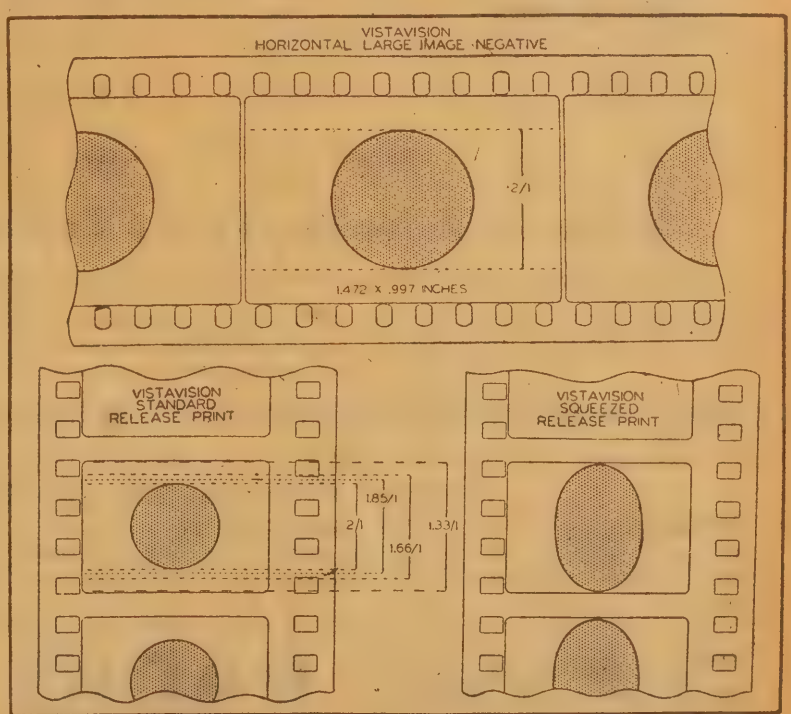

Diagram showing the relative size of the new negative (top) with the old (lower left). The shaded portion shows the direct interest area in each case. Lower right is the special squeezed release print intended for special cases only.

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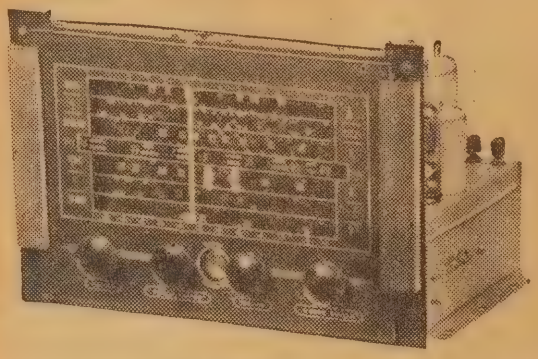

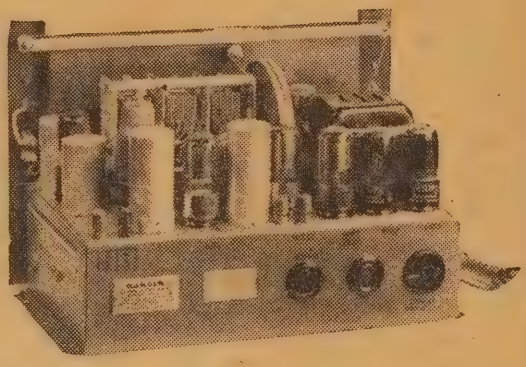

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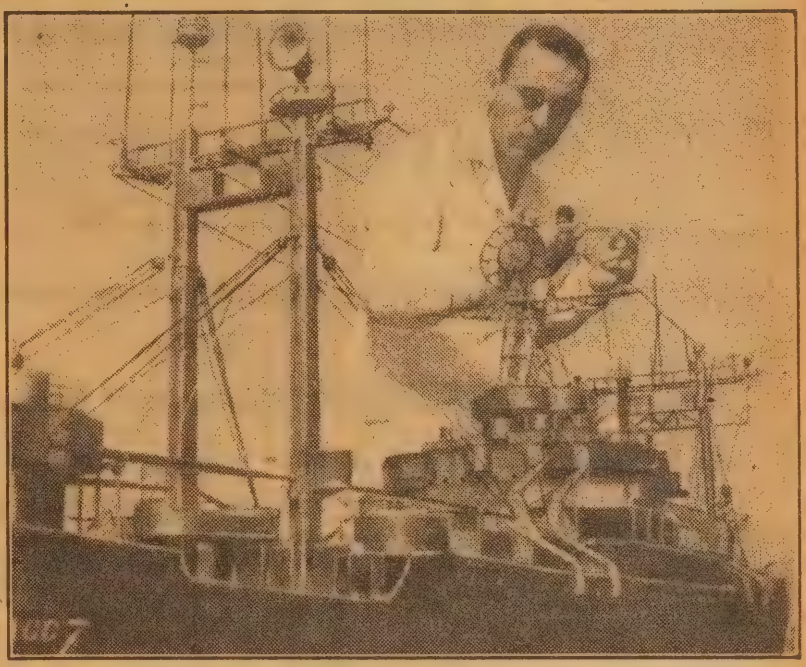
SCALE MODEL SHIPS PREDICT ANTENNA PATTERNS

One of the world's most unusual fleets sails on a specially constructed ocean of lead at the Navy Electronic Laboratory's Ship Model Range in San Diego, California.



Scale model of USS Mount McKinley tested at scale radio frequencies to determine directivity effects caused by ship's structure. (By courtesy of "Electronics").

EVERY vessel in the force is a scale replica of a real US Navy warship already at sea or on drawing boards for tomorrow. The vessels and the model range are used in continuing studies of ships' antenna systems.

Thousands of dollars and manhours are saved annually by the techniques developed during and since World War II.

First approach to the antenna system study was to test and measure antennas on operating ships, a procedure painfully expensive in terms of ship availability as well as money. Furthermore, new ships need accurate forecasting for communications design.

The Bureau of Ships began in 1944 a complete shore-based ship model systems study. From 1945 to 1948 techniques and instrumentation were investigated on a series of preliminary facilities. Permanent plans were ready by 1948. The present range and model laboratory has been in operation since 1950.

Valid results may be obtained from models, experience shows, if the ship size and wavelength are scaled to the same value.

It has been found that for frequencies greater than 2 Mc the ship's structure usually has considerable effect on radiation patterns. Below 2 Mc the structure is usually too small in terms of wavelength to affect patterns.

The primary factor influencing directivity for vhf-uhf antennas, which are usually installed high on the mast, has been found to be nearby objects.

A natural division of instrumentation has resulted, therefore, with one set of techniques for the 2-to-30 Mc range and another for vhf-uhf. Complete ship models are made for the 2-to-30 Mc studies.

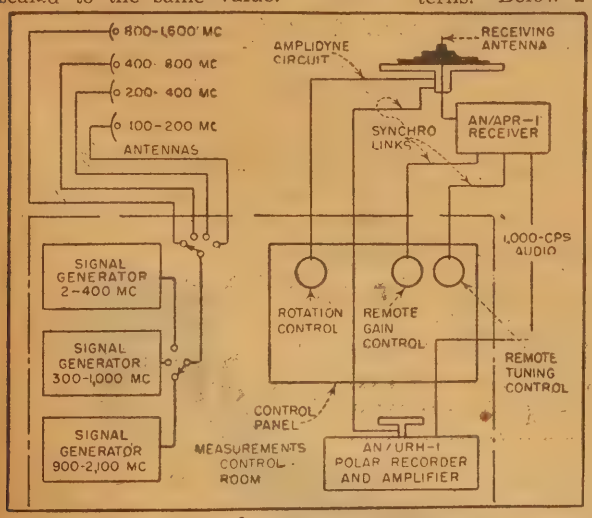
They are built usually to 1/48 scale (sometimes to 1/24) for ease in construction and to utilise available electronic equipment. Each model ship is made of sheet brass.

The ocean is simulated by a large, unobstructed, highly conducting ground plane. Centre section of the plane is a flat metal turntable 22 feet in diameter. Surrounding it is a circular asphalt-concrete field, 160 feet in diameter, covered with a 0.008-inch coating of sprayer lead.

To record an antenna directivity pattern a continuous signal is sent to the model from a parabola at the edge of the field. The model antenna under test is connected to a receiver from which an audio output is obtained.

The magnitude of the audio signal

(Continued on Page 41)

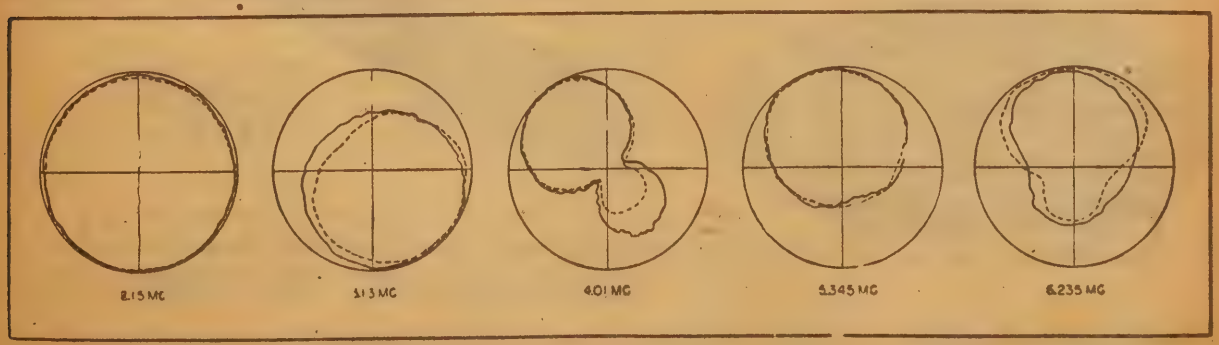


☆

Model antenna is illuminated by proper frequency.

☆

Comparison of antenna patterns of actual ship (dotted lines) and scale model (solid lines).



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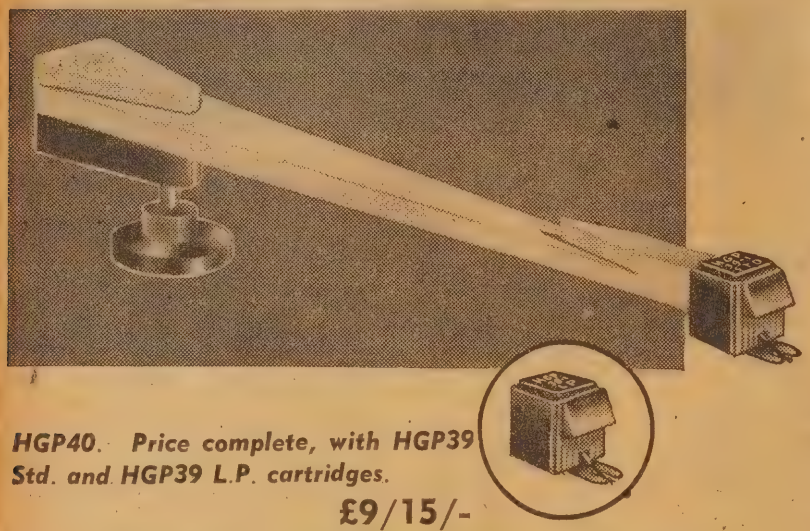

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Response flat from 40c/s to 13 Kc/s with an overall response from 20 c/s to 17 Kc/s. Tracking weight 8 grammes.

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Output 1 volt on standard records. Incorporates easily changeable 0.00025in sapphire stylus.

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Output 1/3rd volt on microgroove records. Incorporates easily changeable 0.0001in sapphire stylus.

HGP38 CHARACTERISTICS

Output 1 volt on standard and $\frac{1}{4}$ volt on long playing records. Tracking weight 10 grammes maximum. Response characteristic smooth with no resonance. Cartridge works into load resistance of $\frac{1}{2}$ megohm and crystal capacity of 1000 picafarads ensures adequate bass response.

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NEWS AND VIEWS OF THE MONTH

Airborne army news

THE British Army's plan to make greatly increased use of "air lift" for the future movement of troops and equipment is now taking firm shape.

Recently an order was placed for a new jet transport and orders for other aircraft were increased; further aircraft types are being studied.

Although it will be some time before big transports are in service, it is now possible to foresee the day when a squadron of high-speed transport aircraft can fly more than 1000 men to a distant battlefield in a matter of hours — a movement which takes weeks by ship and days by smaller present-day aircraft.

Today, more British aircraft firms than ever before are working on designs specifically with army requirements in mind.

PATTERN FOR FUTURE

The future pattern of air operation by the army is expected to be along the following lines: First, a very fast "cannonball" service, which will move large numbers of urgently needed troops or equipment very quickly to trouble spots. This is the Vickers 1000.

Second, a fleet of much slower "heavy lift" propeller-driven transports designed for a dual purpose—to drop troops and supplies by parachute or to take them in to land at advanced forward airfields where grass is the only surface on the runway. This work will be done by Blackburn's Beverley. Twenty Beverleys were originally ordered and this order has now been increased.

The Beverley's carrying capacity can be judged by the fact that it will hold 10 jeeps in the main freight compartment as well as troops in the rear fuselage. For lifting equipment, the Vickers 1000 carries its own electric lift, which picks heavy loads up off the ground and raises them to the freight deck.

CHEAPER TO USE

These large aircraft have been ordered not only because they can do some jobs which could only be performed very slowly and with difficulty by surface transport, but also because in many cases movement is cheaper by air.

In particular the "cannonball" trooping service will enable Great Britain to keep a mobile strategic reserve in being, ready to fly at once to trouble-spots, without the expense of men in the pipeline of the slow troopship.

There may also be increased use by the army of "bush" transports, which take small groups of infantrymen—perhaps only a section—in and out of small grass fields right up on the front line if necessary. The Scottish Aviation Pioneer Beaver, hundreds of which have been bought by the American Air Force and used in Korea, is now also available in Britain.

HELICOPTER

Finally, for the distant future, there is the helicopter. The army's interest in helicopters has been greatly increased as a result of a high-level study recently made of the impact of atomic weapons on the whole tactics and strategies of armies.

It was discovered that the large fleet of wheeled vehicles which has become a necessary accompaniment of the modern army will be very vulnerable to atomic attack.

The army has, therefore, made a study of the extent to which wheeled vehicles "can be carried by air". The army's intention is to introduce helicopters to the maximum extent because it is felt that these flying "jeeps" and "15cwts" will be invaluable in atomic warfare.

Under study are not only conventional helicopters, but also lifting units which can be attached to different containers to carry them through the air for short distances.

★ ★ ★

"Brains" take over

ELECTRONIC brains will take over the work of 250,000 clerks in the next five years.

The clerks work in the bookkeeping and pay departments of British factories.

The machines are likely to replace half the present total of clerical workers in the biggest business houses in the future.

New developments in electronic brains and calculators make this possible.

Previously, electronic computers cost thousands of pounds, and had up to 10,000 radio-like valves.

Now they are smaller, using only 300 valves and costing a few hundred pounds each.

Experts say the new machines will not cause unemployment, because already office workers are hard to get.

★ ★ ★

Jet trainers

AT the end of June the initial flights took place of the world's first "basic training" jet aircraft. This is the Jet Provost, built by Hunting Percival.

It has been designed as an ab initio trainer, to give pilots experience of jet handling characteristics

POPULAR SCIENCE QUIZ

Q. What role can zirconium dioxide play in jet engine design?

A. Zirconium dioxide is a white change when subjected to heat. Such changes can cause a structural failure of the material. However, combining special additives with the powder, ceramic research scientists have been able to produce zirconium dioxide that can withstand heat up to 4000 deg Fahrenheit.

This may well make possible better combustion-chamber liners for ram jet and rocket engines, as well as better engine nozzles. Such parts are subject to searing heat in rocket and jet engines. The powder may also be used eventually on turbine blades.

The stabilisation process can be done at temperatures lower than ever before and the technique should permit workers to use new fabrication methods that will help cut manufacturing costs.

Q. What main gases constitute Jupiter's atmosphere?

A. According to Dr. W. A. Baum, of the Mt. Wilson and Palomar Observatories and Dr. A. D. Code, of the Washburn Observatory; light curves of the gases composing the outer layers of Jupiter's atmosphere indicate that it is made up largely of hydrogen and helium and not ammonia and methane as was previously thought. Nitrogen and oxygen, the heavier gases which make up most of the earth's atmosphere are believed to be almost absent on Jupiter.

The observations were made when Jupiter eclipsed a bright star, Sigma Arietis, note being taken of the rate at which the light from the star was dimmed and finally extinguished by the planet.

A 60in telescope was used in conjunction with a photomultiplier which is a sensitive instrument capable of recording electrically the faint light from the star.

Q. How keen is the human eye?

A. Experiments conducted in the USA have demonstrated that the human eye is more than a hundred times keener than photographic film or devices that detect heat and light.

Combining experimental results from other measures of the functions of the eye, a measure of the ability of the eye to detect light was determined as 35,000 compared with about 350 for a good lead sulphide photoconductive cell, about 200 for high-speed photographic film and about 1, on the same scale, for one of the best thermocouples.

The best performance of the human eye with respect to other detectors is obtained with short light pulses. The angular size which gives best performance is from one to ten times the angular diameter of the moon.

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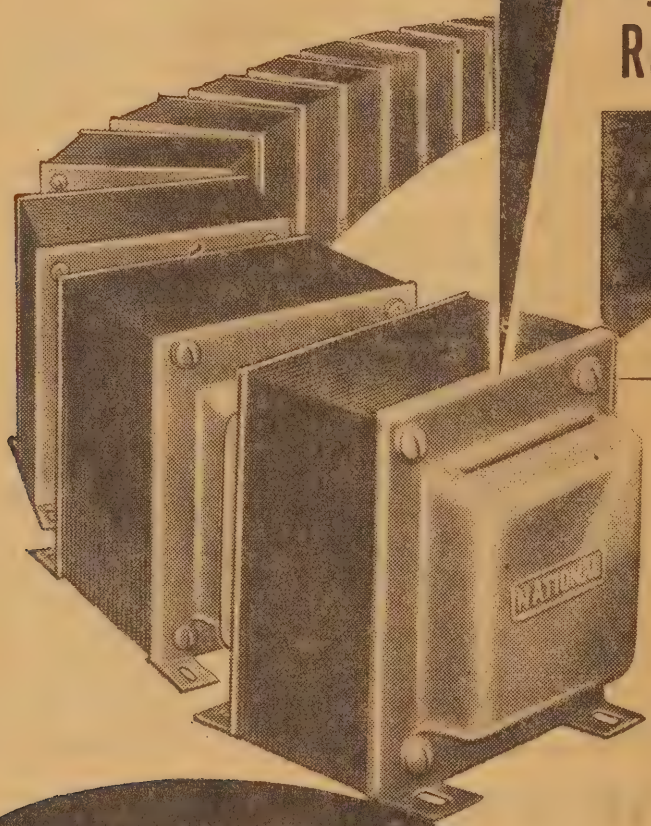

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from the beginning of their flying career. The engine is the Armstrong Siddeley Viper, an axial flow jet motor.

The design is based on that of the piston-engined Provost, which is the standard trainer of the RAF.

Although a jet aircaft consumes something like three times as much fuel as the equivalent piston-engined machine, the latter uses high-octane fuel, which is three times as expensive as the kerosene used by the jet.

But the great advantage of the basic jet trainer is that it eliminates the need for a conversion course for young pilots to teach them jet flying after they have learned to fly a piston-engined machine. Furthermore, the simplicity of the jet means that fewer highly-skilled maintenance men are required, and the initial cost of the engine is likely to be lower.

Under an all-jet training system, there are no major differences of technique to be taught when progressing from elementary flying to advanced aircraft. Hence more hours can be put in on the basic trainer, which is much cheaper than its advanced counterpart.

★ ★ ★

"Activated" plastics

WHILE it is realised that plastics invade every branch of industry, this modern invention is also invading the domain of the atom pile. A discovery made at the Bepo atomic pile at Hanwell has shown a curious new combination, one more plastic material.

As is known, plastic materials are essentially giant molecules formed of atoms in chain constituted of filaments strong enough by themselves to slide one over the other. It is this on a large scale that gives the property of elasticity.

Now, the irradiation of certain plastics, such as polythene in the interior of an atom pile provokes between atoms of two juxtaposed filaments an adhesion which attaches them one to the others.

A product of a very different texture from the original has thus been obtained, and one possessing considerable advantages, insolubility for example in organic solvents and resistance to high temperatures. The importance of this discovery is considerable and experimental manufacture has begun.

★ ★ ★

A new fire-resisting glass

FRENCH journalists during a visit to the glass works at Saint Gobain, were shown a new fire-resisting glass, known as Sedlex. Its composition is the same as Pyrex (borosilicate double of aluminium and sodium) but it undergoes a special treatment to make it capable of resisting sudden changes of temperature. A plate of the new material may be taken off the fire with a damp cloth and laid on an ice-cold surface and cold water poured on it. Another advantage is that the new composition is perfectly limpid and does not tend to take a greenish coloration with use.

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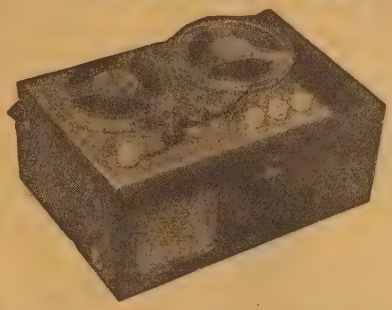

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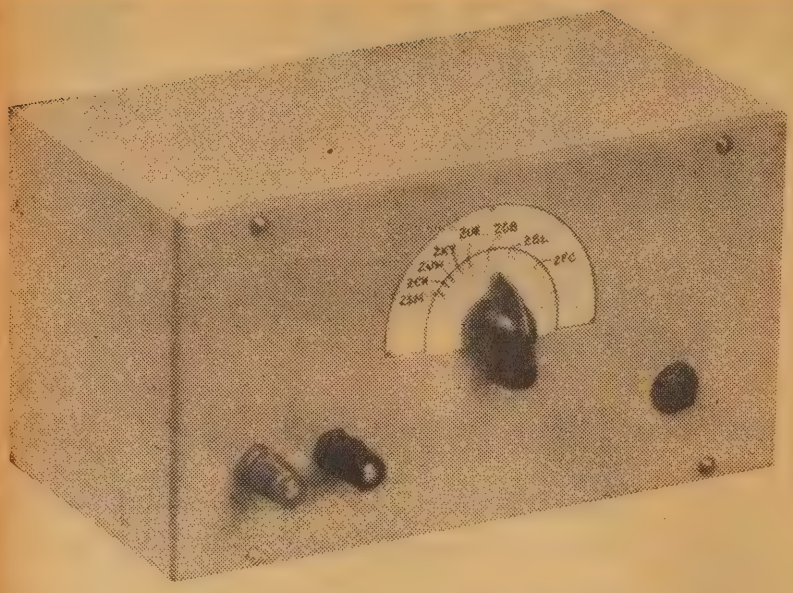


A front view of the completed receiver, housed in a lacquered case and complete with a calibrated dial. The circuit is more complex than the usual crystal set and provides scope for those who may like to do a little experimenting. It costs very little more to build than the simpler type.

A DE-LUXE CRYSTAL RECEIVER

"Surely, dad, you can build me a set that will get all the stations?" This question, with special emphasis on the "you", prompted a member of our staff to build the De-Luxe Crystal Receiver pictured above. As the dial markings suggest, it did ultimately get all the stations at usable strength and without interference.

ADMITTEDLY, these results were achieved in a rather good area for crystal sets, some five or six miles airline from the local stations. Lots of people, however, live in the same or an equivalent area and they too can rightly expect first-class results.

Others are less fortunately placed, from the point of view of crystal sets, and the number of available stations will dwindle as a result. However, other things being equal, you will generally find that this set will out-perform any of the simpler types.

NOVEL CHANGE

As a change from bigger sets and amplifiers, it gave us quite a kick to coax from it the last ounce of performance and to hear the local stations come in one after the other, as we tuned around the band.

Unlike other receivers, a crystal set has no provision for amplifying the incoming signal and the loudness of the sound in the earphones is entirely dependent on the amount of signal which the aerial can pickup.

Fundamentally, therefore, crystal sets can only be relied upon to give worthwhile results in strong signal areas and in conjunction with an effective aerial and earth. There can be no question of operating them from the familiar few feet of wire dangling on the floor.

Against this is the undeniable advantage that they require no power for their operation and have no valves to wear out. Children can use them without danger of electric shock and without interfering with other people's listening habits.

"Junior" can be tucked into a warm bed and allowed to listen for a specified period, while father uses the main set for programs of his own choice. There's a lot to be said in favor of the idea, when his next birthday comes around!

Most of the crystal sets we have described to date have been deliberately simple affairs, using a single tuning capacitor and a single tuning coil with a variety of tappings for the aerial and detector circuits.

ADJUSTMENTS

These tappings are all-important and provide the basis for individual adjustment. After completing the set and installing the aerial and earth, the constructor has to experiment with them to obtain the best overall results.

It is generally found that tapping the aerial and detector circuits across a large proportion of the coil gives loud signals in the phones but poor selectivity. In other words, the stations tend to overlap.

Using tapping points closer to the earthed end of the coil has the opposite effect, in that the selectivity improves but the signals in the phones become weaker. It's just a matter of balancing one thing against another to get the best all-round results.

Circuits like this at the writer's location had never yielded more than five or six of the eight local stations and the only hope of meeting "Junior's" challenge was to go to a more ambitious tuning system—hence the new circuit arrangement, as shown on page 31.

We knew, too, that the coils would have to be wound with fairly heavy wire to maintain electrical efficiency. That, briefly, is the story behind the "De-Luxe Crystal Receiver".

Let's see how it works: Signals arriving via the aerial are fed to a tapping on the first coil. This coil is tuned by one section of the variable two-gang capacitor so that it can be made resonant (or responsive) to the signals from a particular station.

Signals from stations on other frequencies are rejected while the wanted signal bulids up a maximum voltage and current in the tuning coil. The coil also surrounds itself with a magnetic field which oscillates (or vibrates) at the frequency of the wanted station.

This is the essential mechanism of tuning.

As the next step, signals from the first coil are transferred to the second one which is (or should be) tuned to the same frequency as the first. Just how the signals are transferred we will see in a moment.

MORE SELECTIVITY

Here a further process of selection goes on, the wanted signal being favored, the others rejected.

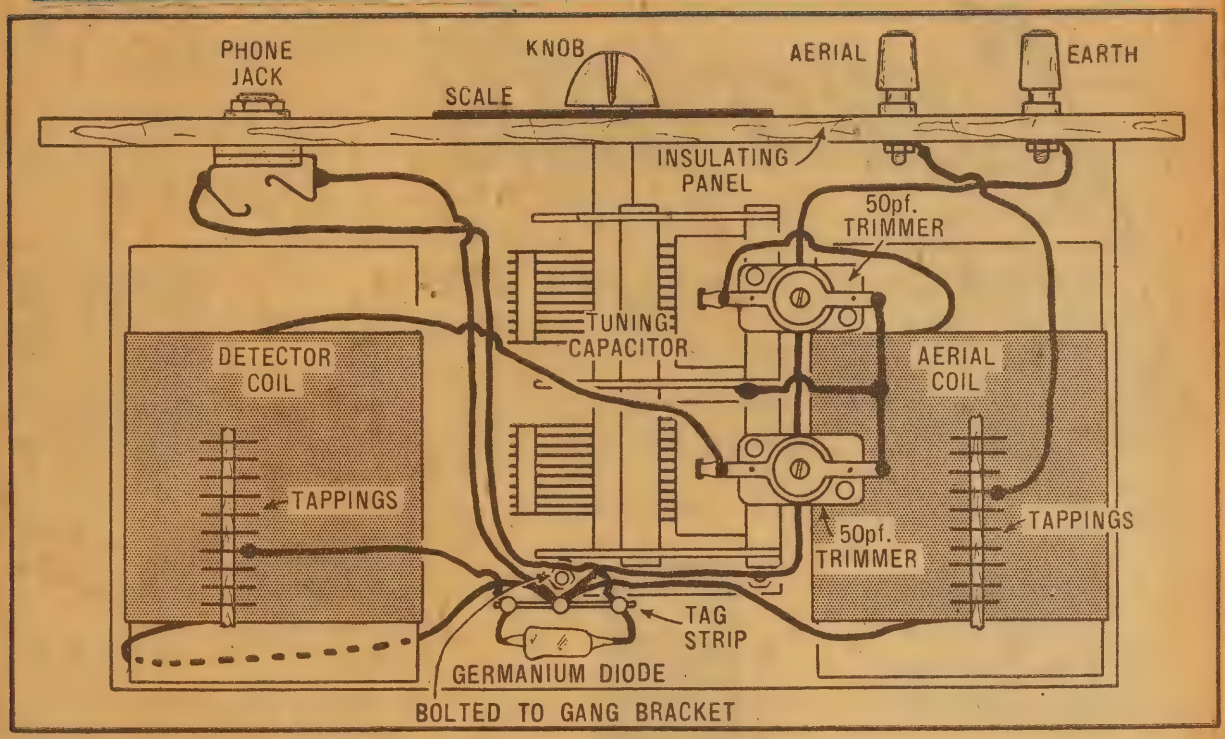
Finally, the signal is taken from a tapping on this coil and fed via the detector to the earphones.

The process of adjustment is at least as important as the circuit itself.

As in the case of the single tuned crystal set, it is most important to choose the best tapping positions for the aerial and detector leads. If they are tapped too far up the respective coils, they lose their ability to discriminate against unwanted signals.

In other words, the "loading"

DIAGRAM SHOWS POSITION OF WIRES AND COMPONENTS



Here is the complete wiring diagram. The frame of the tuning gang provides a natural return point for all "earthed" leads. The centre mounting lug of the tag strip supporting the detector is supported by one of the gang mounting screws.

effect of the aerial and detector on the coils ruins their selectivity.

Conversely, too low a setting for the tappings reduces the strength of signal heard in the phones. The best settings are those which give you the loudest signals from stations available in your locality, without mutual interference.

Then you will notice that there are "trimmer" capacitors connected across each section of the tuning gang. These are adjusted at the high frequency end of the band—around 2CH and 2SM in Sydney—to ensure that both coils tune to exactly the same frequency. In other words, the "trimmers" correct any discrepancy in the total capacitance across each coil.

Correct alignment at the low frequency end—2FC in Sydney—is assured by making the coils exactly similar.

Finally, there is the matter of coupling between the two tuned circuits. It only needs to be very small, electrically, otherwise the tuning will not be as sharp as it should be. In fact, too much coupling can give two distinct peaks on each station and that is certainly not what we want.

OPTIMUM COUPLING

In the original set, we got just about the right amount of magnetic coupling by mounting the coils in the same plane but separated by the width of the tuning gang. This was one of the smaller types and allows the inside edges of the coils to be 2¾ inches apart. If you use a larger capacitor, the distance would have to be increased somewhat and the coupling might not be quite tight enough for best results.

There is no need to be worried about this, however, because coupling between the tuned circuits can be arranged in other ways.

"TOP" COUPLING

The simplest of these is known as "top" coupling and involves nothing more than a very small amount of capacitance connected between the two sets of fixed plates in the tuning gang.

A likely value would be a 4.7 pF. capacitor, available now from most radio stores.

Alternatively, you can make up your own coupling capacitor by soldering a short length of plastic covered hookup to each of the fixed plate terminals, then twisting the two wires together for a distance of about two inches.

Clipping the twisted section shorter than this will naturally reduce the capacitance.

Another idea is known as "bottom coupling". Normally one end of each coil returns to earth, as shown on the wiring diagram. However, a degree of coupling can be introduced by joining the two ends together and running them to earth through a large value paper capacitor, normally about .05 mfd.

Smaller values than this will give more coupling but may lead to a double humped tuning effect. Larger values of capacitance reduce the coupling.

You will not normally need to worry about this bottom coupling idea but we mention it for the sake of those who may want to experiment. In fact, you can learn quite a lot from building and experimenting with this little set.

PARTS LIST

Small quantity of 3/8 and 3/16in. ply for case and panel.
1 2-gang capacitor, 400 approx. pF, preferably small type.
2 50pF trimmers.
1 Knob, to suit dial spindle.
2 Pieces coil former, 2in. diameter, 3in. long.
¼lb. of 22 B&S gauge enamel wire.
1 3-lug tag strip.
1 Germanium diode detector.
1 Pair headphones, preferably high impedance.
1 Phone jack.
2 Terminals (red and black.)
Approx. 3ft. of hook-up wire, nuts & bolts, solder, etc.

PANEL & BASEBOARD

Now for a few words about the construction. Our set was assembled on a ⅜in plywood base measuring 7in. x 3¾in—this being the smallest size which would comfortably mount all the components. You may have to vary these measurements slightly to suit yourself.

The panel measures 8in x 4¼in and is glued and tacked to the baseboard with a ⅜in lip underneath.

To house the set, we knocked up a box 8in wide, 4¼in high and 4in deep (outside measurements), making the sides, top and bottom from the ⅜in ply and the back from 3-16in ply.

This was glued and tacked to-

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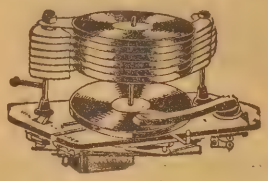

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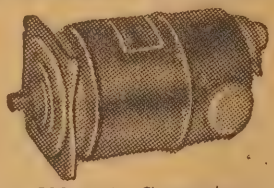

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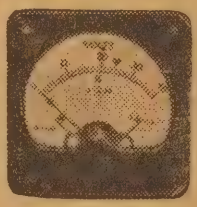

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gether, the holes filled wtih plastic wood and then sanded smooth.

Once having determined the sizes, it is actually a good idea to do all the carpentry at the outset, so that the box and panel can be dressed to an exact fit. This is up to you, however.

As a finishing touch, we undercoated the wood, then lacquered the panel in mid-grey and the box in light green—two colors which just happened to be on the paint shelf.

SPINDLE POSITION

Coming back to the set itself, the gang should be mounted so that the spindle is along the vertical centre line of the panel and high enough to give a good balance to the appearance.

The spindle should protrude far enough to mount the knob, which should preferably be bought to fit it. As an emergency measure, some knobs with ¼in holes can be drilled to ¼in without wrecking them.

Four countersunk screws and nuts driven from underneath the baseboard can be used to secure the gang, or you may use short woodscrews driven into the baseboard.

The dial, which you see in the photograph is simply drawn on white card and, after calibration, covered with a scrap of celluloid and pinned into place.

Winding the coils is probably the most tedious job in building the set, although it calls for no particular skill. Try to get 22 B & S enamel because it will ensure the largest and most efficient coil on the available former.

The use of thinner wire may reduce the efficiency somewhat, while thicker wire will demand a longer piece of former.

Assuming the use of 22 B & S enamel, drill two small holes close together and ¼in in from each end of the former.

Have a couple of matches handy, with the heads trimmed off, because you will need these to support the tapping points.

Now loop one end of the wire a couple of times through one set of holes and proceed to wind on five turns, keeping the wire taut and the turns placed accurately side by side.

Slip the end of one match under the fifth turn and then pass the sixth and succeeding turns underneath the match again.

When you get to the tenth turn, push the match along and run the tenth turn over the top of it, the eleventh and succeeding turns going underneath again.

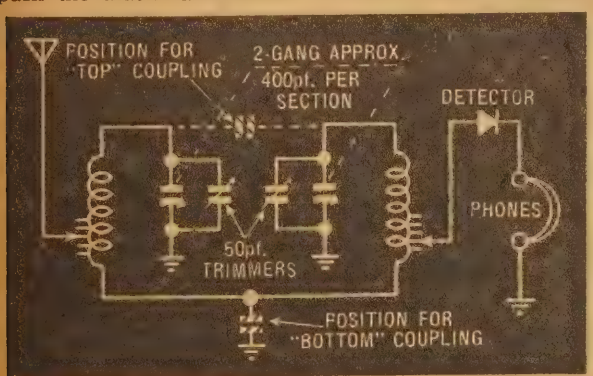
Continue in this fashion until you have wound on 50 turns, with a tapping every fifth turn. Far from complicating the winding, you will find that tappings made in this way help you to keep good count of the turns.

FINISH OF COIL

After the 50th turn, wind on 30 more, to make 80 turns in all, no more and no less. The 80th turn should be looped a couple of times through the holes in the end of the former and this much of the job is complete.

Having made two such coils, exactly the same, small holes can be made in the ends of the former to receive a couple of mounting bolts up through the baseboard.

Before mounting the coils, however, mount the terminals on the baseboard and the earphone jack, making sure that the latter is placed so that the tongue of the plug will not foul the coil former. If needs be, terminals could be used equally well for connection to the phones.

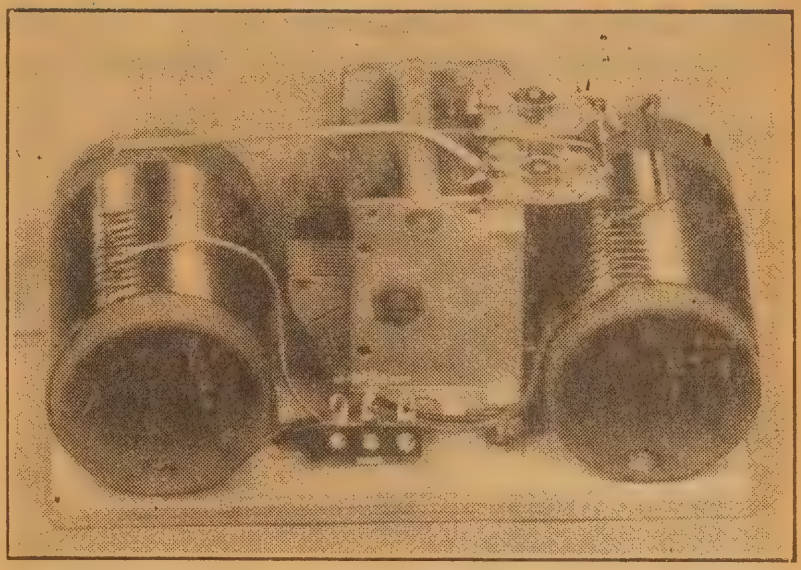


☆

And here is the circuit diagram. Normally the bottom end of both coils would return to earth but the insertion of a capacitor in the position shown will give "bottom" coupling. The position for a top coupling capacitor is also indicated.

☆

REAR VIEW OF THE FINISHED SET



A rear view of the completed set. Note how the trimmers attach directly to the top of the tuning gang, the "earthy" ends being returned by busbar to the frame. The crystal mounts across the tag strip in the foreground.

Since we have assumed the use of a plywood panel and baseboard there need be no insulation problems.

Having mounted the terminals and jack in place, the coils can be mounted in position.

As mentioned earlier, a 3-position tag strip should be secured under one of the gang mounting bolts to hold the detector diode. The centre lug, being in contact with the gang frame, makes a handy earth return point.

The germanium crystal diode can be any one of a variety of types and we suggest, when purchasing it, that you explain that you want it for a crystal set. Germanium diodes are permanent in their adjustment and more sensitive than most ordinary crystal detectors.

When mounting the trimmers, solder the side which does NOT touch the adjusting screw to the gang fixed plates. The other ends can be joined with a scrap of tinned copper wire and a return wire soldered back to the frame of the gang.

READY FOR TEST

The remaining few wires can then be added and, after installation of the aerial and earth, your set is ready for a try-out.

Within five or six miles of the stations, you will get by with about 30ft of aerial, 10ft or more from the ground. In more remote suburbs you will need just about to double these figures. Further out again, you might get signals only if you are very lucky and are prepared to erect a really enormous aerial—100ft long and 40ft high!

Our set worked well with the aerial connected about 30 or 35 turns from the earthed end of the first coil and the detector about

(Continued on Page 63)

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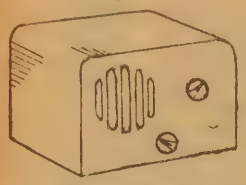

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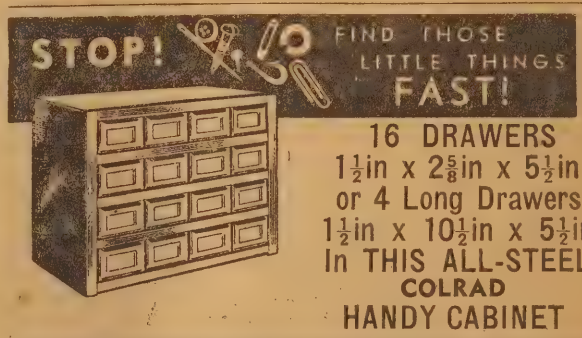

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FROM THE SERVICEMAN WHO TELLS

Perhaps I can do no better, by way of introduction to this month's instalment, than tell a very unusual story about a wrecked radio cabinet. I don't think I've mentioned this subject before in these columns, so at least it's different.

THE first time I saw the set in question was when it was lowered rather gingerly on to the counter by its very forlorn owner. Though it was still clearly recognisable as a radio receiver, the interior "works" were now visible through several ugly gaps in the cabinet.

As I watched, the owner proceeded to extract from his overcoat pocket two or three large slivers of walnut bakelite.

The set was practically new, he told me. It had recently been given pride of place on an occasional table and, yesterday, his small daughter got her feet tangled in the power cord, pulling the whole concern on to the floor.

It had fallen at the wrong angle, breaking the cabinet into several pieces.

As I inspected the result, I could see that the front, top and one side were more or less intact. However, the bottom was hanging only by the chassis bolts, the remaining end was broken right away and there were the other couple of odd bits that I've already mentioned.

What was worse, said the owner, the set would not play any more.

Would I fix the set and "was there any way we could patch up the cabinet?"

ONCE BROKEN—!

It was my painful duty to explain that, as far as bakelite cabinets are concerned, it's a matter of "once broken, always broken"

Little pieces could possibly be stuck in place with glue but there wasn't much chance of sticking together a very large and very shattered cabinet like this one. I had heard of special bakelite adhesives but had never seen them in the shops.

A new cabinet was the only answer.

"How much would that cost?"

I wasn't sure but I knew that an average replacement cabinet costs about £3. This one, being a much larger type, might run to around £4.

His forlorn expression gave place to one that was even more so.

"What with rent, doctors' bills, furniture instalments and all the rest," he explained, "I simply can't spend another penny at the moment. It'll simply have to sit on the table as it is . . . that's if you can make it work without too much expense."

What could a poor serviceman do?

I suggested that it need not be quite a bad as all that. He had a few tools at home? Yes.

Well, he could pick up a packet of bifurcated rivets, something less than an 1-8in in diameter and long enough to go through the bakelite cabinet. He would need a few scraps of about 20 gauge aluminium, a pair of snips, a small hammer, a drill, and something to serve as a riveting block.

The idea was to cut strips of aluminium about an inch and a half wide, lay them along the breaks inside the cabinet, drill holes either side of the break every couple of inches and rivet the pieces of cabinet to the metal patch.

He would have to be very careful in fitting the pieces together, avoid stressing the bakelite and clinch the rivets without hitting them too hard.

Well, he waited for me to remove the chassis from the cabinet and then walked out with the "remains" under his arm. Beneath his prevailing air of tragedy, I could sense a new determination.

Just out of curiosity, I plugged the chassis into the power and switched on. After a few moments, it started playing stations. A couple of the valves were tilted in their sockets, two or three of the heavier bypasses had strained at their lugs but that was all.

Even the glass dial and its pointer were unharmed.

I tip that, in falling off the table, the set had been pulled away from its aerial lead and this, coupled with the disturbed state of the household had led them to believe that the chassis also was a wreck.

I duly pushed the condensers back into place, straightened up the valves, tuned across the range and left the set playing for the next hour or so. Everything was quite okay.

Next morning, the lady of the house called in with the cabinet "tooked underneath 'er arm". Apparently her man had drilled away and tapped away at it till the wee hours of the morning, then gone to bed droop-eyed but happy.

And what a job he had done! I wouldn't have been game to sit on it but at least it would stay together for a while.

A FAIR JOB

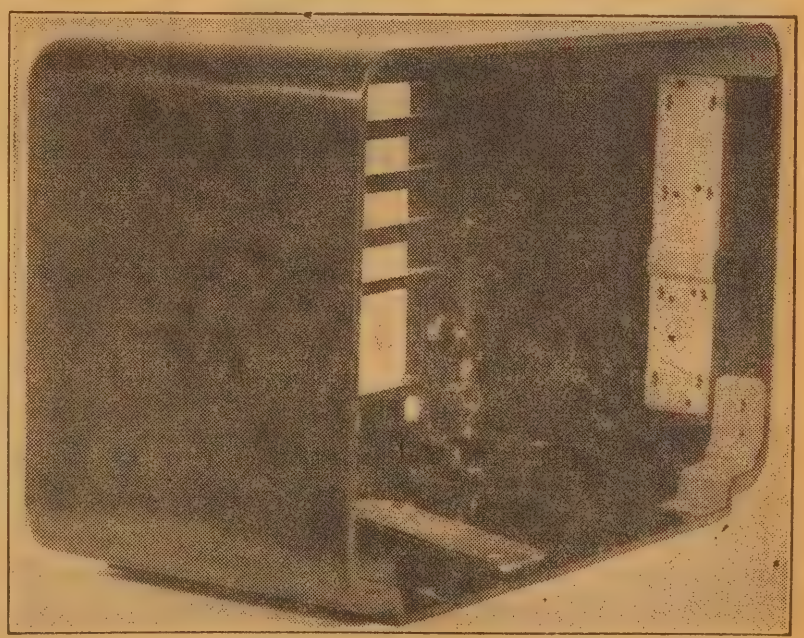
Inside, it was a pattern of rivets and aluminium strips, but the outside didn't look too bad. He had touched up the rivet heads with brown lacquer and, to the casual observer, they weren't at all obvious.

When I told her that the chassis was undamaged, her delight knew no bounds. I fitted the pieces together, made the set play stations and told her that this job would be "on the house".

But I went on to suggest that they buy a new cabinet as soon as possible. That one would not stand being carried around and, furthermore, a receiver in a broken cabinet was practically worthless as a resale or trade-in proposition, no matter how good it was in other respects.

I explained that most major manufacturers carry spare cabinets in stock but the supplies of a particular model sometimes run out.

Of course, if the dies happen to be damaged at any time, there would be no more anyway!



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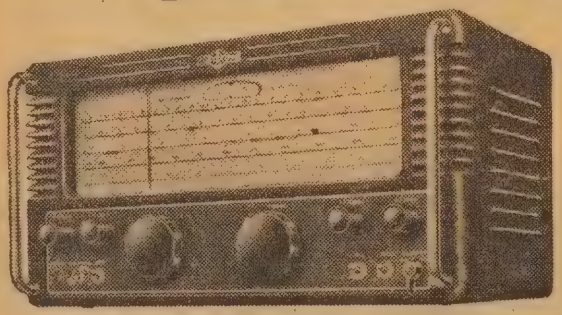

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FREQUENCY RANGE: Band 1—32 to 12 Mc.; Band 2—12 to 4.5 Mc.; Band 3—4.5 to 1.7 Mc.; Band 4—1465 to 480 Kc.
VALVE LINE-UP: Eleven valves perform the following functions—

R.F. Amplifier	6BA6	Det., A.G.C. and A.F.	DH77
Mixer (S.F. to 1620 Kc.)	ECH42	N.L., S Meter Diodes	6AL5/D77
Oscillator	6AM6/Z77	Output	N78
Fre. changer (to 85 Kc.)	ECH42	Beat Freq. Oscillator	6BA6
I.F. Amplifier	6BA6	Rectifier	5Z4G
		Stabiliser	VR150/30

ELECTRICAL PERFORMANCE: Double Conversion Superheterodyne. Sensitivity is better than 5 microvolts for a 15 db signal/noise ratio at all frequencies.
SELECTIVITY is variable over the range 30 db to 60 db down 5 Kc. off resonance. Image ratio is better than 40 db at 30 Mc. and greater at lower frequencies.
AUTOMATIC GAIN CONTROL: Output level is maintained within 15db for a 90 db change of input, above 3 microvolts at 8 Mc.
AUDIO OUTPUT: Maximum output is 3.5 watts. Pick-up terminals are fitted and audio stages give linear amplification over a wide frequency range.
S METER: A socket at the rear accepts the Cat. No. 669 Signal Strength Meter.
FINISH: Fine black ripple.
Weight 40 lbs, width 16¾in, depth 10in, height 8¾in.

Price £128/7/7 (inc. Sales Tax,) Speaker extra)

EDDYSTONE "740" RECEIVER

FREQUENCY RANGE: Band 1—30.6 to 10.5 Mc.; Band 2—10.6 to 3.7 Mc.; Band 3—3.8 to 1.4 Mc.; Band 4—205 to 620 Metres.
VALVE LINE-UP:

R. F. Amplifier	EAF42	Beat Freq. Oscillator	EAF42
Frequency Changer	ECH42	Output	EL42
I.F. Amp. and A.G.C.	EAF42	Noise Lim. and S Meter	EB41
A.F. Amp. and Det.	EAF42	Full Wave Rectifier	EZ40

ELECTRICAL PERFORMANCE: Sensitivity is better than 10 microvolts throughout for a 15 db signal/noise ratio and 50 milliwatts.
SELECTIVITY: 30 db down to 10 Kc. off resonance. Image ratio better than 15 db at 30 Mc. and greater at lower frequencies.
AUTOMATIC GAIN CONTROL: A change of input of 80 db affects the output by less than 25 db.
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By the smile I received as milady walked out, I'm quite sure that the order for a new cabinet will come through me — together with any other custom that might come from the same quarter.

"As a man sows . . . &c."

The memoirs of a radio serviceman could not possibly be complete without numerous and amusing references to troubles with speaker cones.

We have told you about cones being eaten away by rats, being glued into place and cut away with a razor to stop them humming. But the end is not yet in sight.

From Dandenong, Vic., comes a letter from a professional serviceman prefaced by the words "Dear Fellow Sufferer".

Rather than launch into a lengthy story he is content to enclose a copy of the note which accompanied a particular set into his service shop. A case of "every letter tells a story". It read this way:

Dear Sir,

This radio set has been good up to two weeks ago when it went wrong. Something went wrong with the loudspeaker. I just could not listen to it. Low pitched voices were all right, but musical instruments were unbearable.

I took the radio out of the cabinet and found the trouble in the speaker. I put a rolled piece of newspaper behind the black piece (that vibrates) and it gave good results, but the paper kept being pushed out by the vibration, so finally I put a lead pencil in place of the paper. I used too much force and so busted (I think) the black vibrating piece away from the magnet or whatever you call it). Anyhow I settled it so am sending it along to you for repair.

I write these few words so that you won't be looking for the fault elsewhere. The set is not mine, it has been loaned to me and has given me great pleasure whilst I've had it.

(The sticking plaster you see on the black piece was put on after the accident.) It wants a dial light also. Condenser cord or string wants replacing and a knob on condenser for moving.

I'm afraid my only comment could be, "Ah, well, such is life . . ." Anyhow, many thanks, L.S., for your contribution to these columns.

My own experience with a speaker, this month, has an entirely novel flavor.

A mantel receiver was delivered to me by a "carrier" type gentleman, with the usual "I-don't-know-anything" attitude and a rather indefinite instruction to "fix it".

The set looked very dusty outside but I was not prepared for what I saw when I looked in the back. It had all the appearance of having come from the slopes of Kosciusko, except that the white powder inside wasn't snow.

A "FLOURY" ONE!

After a little cautious testing, I decided it was flour! A set in such a state could only have come from a flour mill or a bakery, supplying the wherewithal for "music while you work". It soon transpired that my deduction was correct.

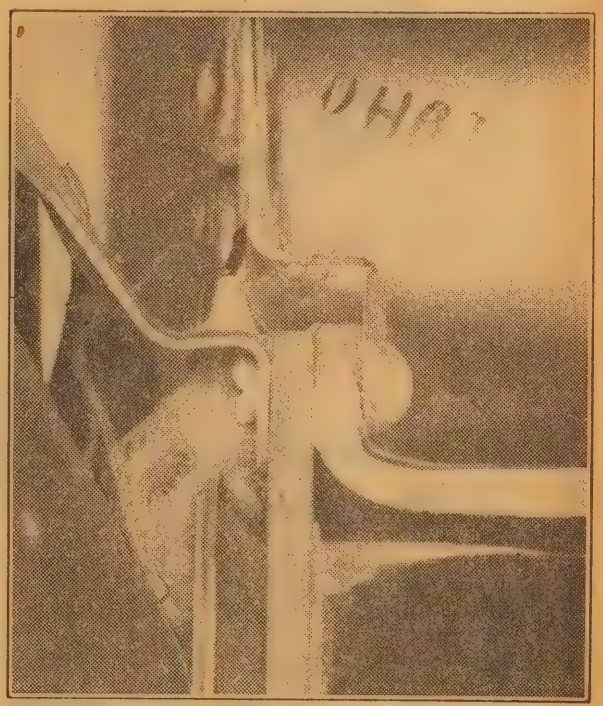
Despite the application of power and the twiddling of all available knobs, the most I could encourage from it was a very weak, distorted output. Probably a worn-out rectifier, I guessed, or an output valve with about 2 pc emission.

After having sucked and blown out as much of the flour as I could with a vacuum-cleaner, I located and tested the two valves in question and the first audio tube for good measure. In point of fact, they were in pretty fair order. It was obviously a case for sterner measures.

The set was duly removed from the cabinet, together with still more flour and dust. This time I pressed the speaker cone and sensed immediately that it was stuck firm. No wonder the set wouldn't work. But why?

By a series of mild contortions, I was finally able to spy something that could have been the body of a deceased mouse jammed down behind the speaker cone. To make any further progress, however, I had to undo a couple of bolts and remove the speaker completely from the chassis.

My "deceased mouse" turned out to be something that I had never dreamed of. The pitch in the output transformer had obviously become sufficiently hot to flow and had oozed down in one large lump between the back of the cone, the centering ring and the pole face.



Sealing compound running from the transformer to the cone spoiled this set's performance.

There it had solidified, effectively preventing all subsequent movement of the cone. The greyish appearance was due, of course, to a mixture and coating of flour dust.

To prove the authenticity of this story, I delayed repairing the speaker (or attempting to) until after a photograph had been taken.

Whether I could successsfully free the cone after that was, of course, a matter for speculation. However, I obviously had to try.

First step was to drill out the rivets holding the output transformer. When I then moved it, I was relieved to feel a distinct crack as the column of pitch broke and left a much smaller piece to be fished out of the cone structure.

This time, the coating of flour proved to be on my side, because it had prevented the pitch from sticking hard to the paper cone. By a little judicious prodding and poking, I was finally able to break and fish the lump out of the works and free the cone for future operations.

But how on earth could a set generate enough internal temperature to melt that black pitch? Most mantel receivers get fairly warm inside but not as hot as all that!

A careful check of the chassis revealed nothing that would suggest overload or abnormal conditions and I could only come to the conclusion that the set had been operating in a very warm situation.

One could imagine several possibilities, ranging from proximity to a heated flue through to sun streaming through a window in summertime.

Since the set was due to be picked up again by the "carrier" type, I preferred not to trust too much to his memory or concentration.

After having inspected, cleaned up and re-aligned the set—all of which it needed—I composed a little "To Whom It May Concern" note, explaining why the set had failed and suggesting that they keep it away in future from situations where it would be likely to suffer from overheating.

Into the same envelope, of course, went another small document which may have lent some point to my advice.

COUNTRY SET

By way of conclusion, I propose to re-tell a story which was passed on to me by a serviceman-cum-electrician friend in the country.

Because of the barriers of time and distance, I can do no more than repeat his findings without opportunity to cross-check them. However, details aside, the principle behind the whole story is interesting and may provide some food for thought.

It seems that a local enthusiast had put together a portable receiver, which may well have been a "Radio and Hobbies" design. However, he was very disappointed with the results and, despite his best efforts at alignment, the sensitivity remained very poor.

According to my friend, the set was a typical five valve type em-

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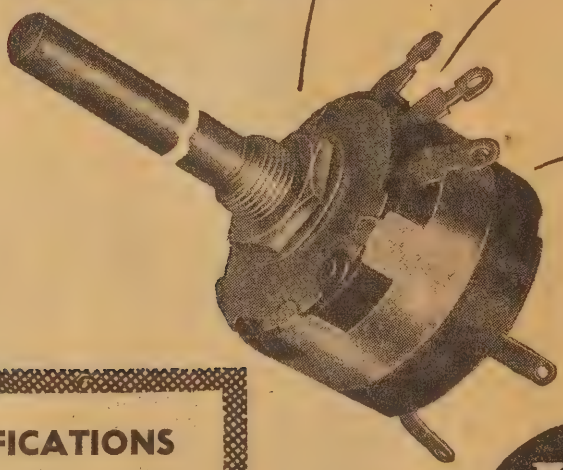

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ploying an RF stage, had been well made, and should have been capable of a very good performance. In fact it was very sick, only a couple of strong signals being able to struggle through.

A valve check indicated that all was well in this direction and he tackled the set proper. A voltage check likewise brought no result and a rough test seemed to indicate that the audio section at least was working properly.

He then coupled the oscillator to the grid of the IR5 converter and commenced to align the IF channel. As the owner had indicated these were not far from the mark and only a turn or two was required in each case to bring them right on the peak. But the gain was hopelessly down, being reckoned according to my friend, in millivolts, not microvolts.

TROUBLE IN IF

Having thus decided that the IF channel was to blame, he went over this portion of the set again. The circuit appeared intact, voltages were normal, and there was nothing to indicate why it would not perform in a normal manner.

However, as luck would have it, while he was probing under the chassis checking around IR5 socket, he accidentally shorted the oscillator grid to chassis. There was an immediate jump in signal from the generator but a return to the previous level as soon as he removed the short.

To find out just how much effect the oscillator circuit was apparently having on the performance of the valve, he therefore shorted the grid again. From millivolts, the input had checked the gain of the IF stage again. From milovolts, the input had now dropped to a much more likely figure for a set of this size.

The obvious course was to find out why the oscillator circuit should have had such a profound effect on the operation of the IR5 as an amplifier. All the component values were right and my friend therefore set about rechecking the operating voltages, this time with VTVM.

USE FOR VTVM

Personally, I would have checked oscillator grid current but my confrere in question is a stickler for his VTVM. It would be unworthy of me to suggest that it also saves him unsoldering the "earthy" end of oscillator grid resistors!

However, he obtained a reading on the oscillator grid of 30 volts which he reckoned to be excessive "with his particular meter."

These last words, which are his own, probably hide a good deal of terror because vacuum-tube voltmeters aren't always above reproach on the RF circuits, either by reason of their accuracy or their possible effect on the circuit being measured.

However, be that as it may, he reckoned that the reading was about double what it should have been.

He then took a second look at the oscillator coil, scowled when he recognised a brand which he didn't like and presumably gave the owner to understand that his best course would be to buy an oscillator coil in another brand which he much preferred.

The oscillator coil might have been wrongly marked or the designer might not have known what he was doing, but in any case he didn't trust them! Such were his sentiments.

In due course, another oscillator coil was obtained in the alternative brand, clearly marked for a IR5. It was installed by the hopeful constructor, roughly lined up and with what a difference.

Plenty of punch, all the smaller stations, &c. . . .

This time, the oscillator voltage was read at 17 — possibly another inaccurate reading but half what it had been before and about what my friend reckoned it should be. Everyone was therefore happy.

The whole story leaves me with a lot of "if's" and "if's" and "buts". The valve curves don't suggest a catclysmic fall in sensitivity with high oscillator grid current, but they only run up to 0.35 milliamp.

The readings were not taken in current but in rather dubious voltage figures. Did 30 volts through 0.1 meg. represent 0.3 milliamp or was the real current very much higher?

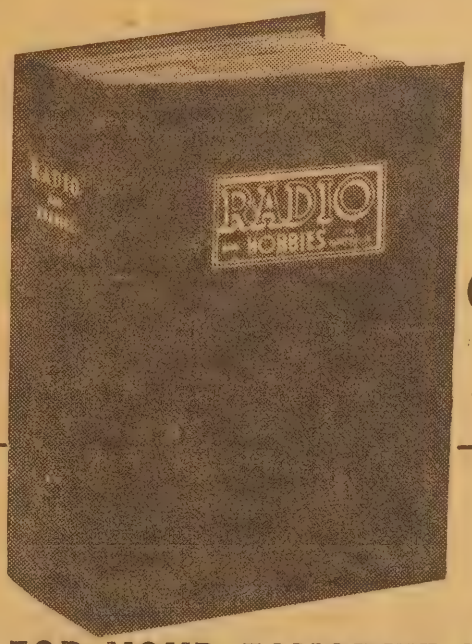
Would the performance have been restored to normal by altering the grid resistor value or by loading the oscillator coil? These questions must perforce remain unanswered because the set is now playing radio programs somewhere in the depths of the bush.

My friend was certainly not worried by them because he had made the set work, hadn't he, and he didn't have to have his ideas and methods scrutinised by a lot of technical magazine readers.

(I should point out that this last paragraph is a mere summary of his rejoinder to my efforts to "quiz" him.)

The moral of the story would appear to be that the sensitivity of a set can suffer greatly if the oscillator coil is so designed that it promotes a degree of oscillation and a flow of grid current far in excess of the valve ratings. Further that such coils do apparently exist!

For normal operation they should either be replaced or (I would tip) loaded down by a resistor directly across either winding until the grid current falls away to the valve maker's recommended figure.



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A COURSE IN TELEVISION

PART 52—THE NTSC COLOR SYSTEM (Contd.)

From the foregoing articles, the reader should have gained a fairly clear picture of the operation of color transmitters following the NTSC pattern and of the signals they radiate. It now remains to see how these signals are utilised in color receivers.

IT must be realised at the outset that a color television receiver is an extremely complicated piece of equipment and is just as involved in comparison to a conventional monochrome receiver as the latter is to an ordinary broadcast set.

It is, therefore, completely impossible, in the framework of a simple article, to do more than convey to the reader a broad conception of how such a receiver operates. To treat in detail subjects like sampling circuits, automatic frequency control, electronic computation, &c., would involve a great deal of space and a fair proportion of advanced mathematics.

Another point is that color television receiver design is still the subject of intensive research by the world's leading engineers, and all are bent on developing techniques which will simplify design, adjustment and maintenance. There is, therefore, little point at this juncture in studying precise circuit arrangements.

POSSIBLE CHANGES

By the time local engineers and service organisations are called upon to deal with color equipment, a great many of the present methods and difficulties will have become history.

In the general view, a receiver designed for the reception of NTSC pattern transmissions must include all the basic elements of a black and white receiver. In addition, it requires circuitry to decode, to synchronise and to amplify the chrominance information.

All this must be accomplished to a high degree of precision and, finally, the receiver must include "convergence" circuits which maintain correct focusing over the whole area of the current type of tricolor screen.

Figure 9 shows a basic color receiver in block schematic form. The aerial and tuning systems can be broadly similar to those of a monochrome receiver, although special care is warranted to achieve a high degree of oscillator stability. This is desirable to minimise drift after tuning and to preserve the correct bandpass characteristic in relation to the signal.

CAREFUL DESIGN

While it is also commonly stated that a conventional IF channel can be employed, in practice greater care is necessary to achieve a full 4.0Mc bandwidth, in order to preserve proper response to the chrominance signals. A degree of nonlinearity in the response curve, which would be of little consequence in a monochrome receiver, can introduce serious intermodulation effects between the quadrature components of the chrominance carrier and, with it, a marked loss of color definition.

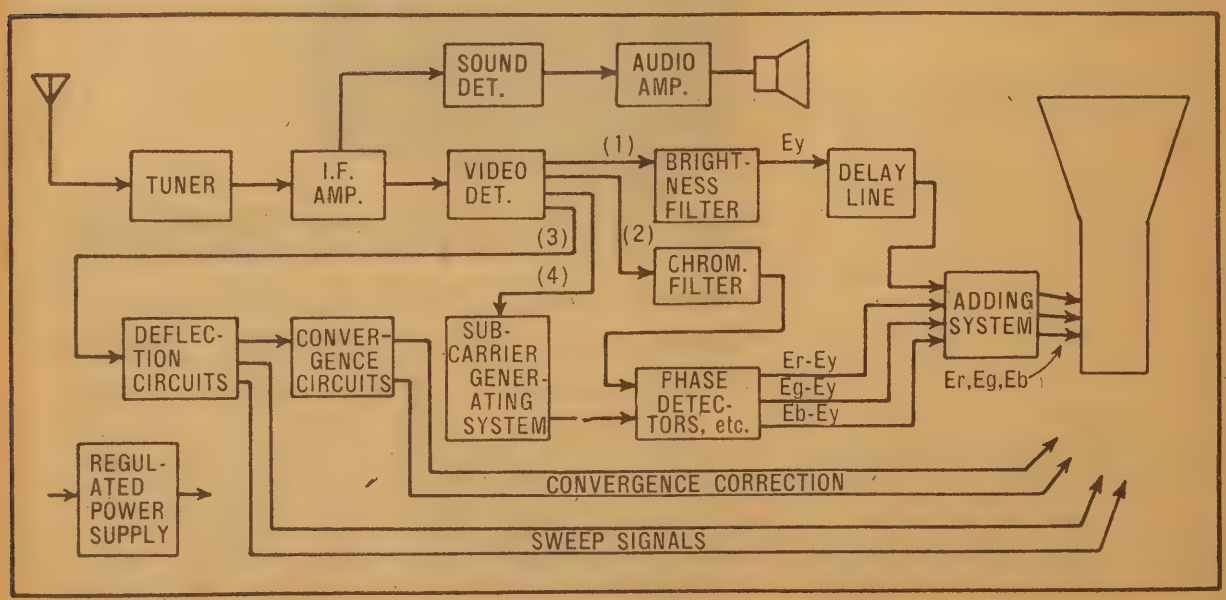
To achieve this near-optimum IF response characteristic, it is often necessary to increase the usual three IF stages to four or even five in all, suitably loaded and/or stagger-tuned. Some receivers effectivly shape the "shoulders" of the response curve by the use of peaking circuits in the chrominance amplifier chain.

INTER-CARRIER SOUND

As a further point, it is standard practice to use the inter-carrier system for the sound channel. (See part 32 of this series, January, 1952.) This involves passing the sound signal through the IF channel as a product of the beat between the receiver oscillator and the sound carrier.

However, the sound signals must be deeply attenuated before reaching the video detector, in order to prevent intermodulation between sound and chrominance signals. An attenuation figure of some 40db appears to be necessary, as compared with 25-odd db in a conventional intercarrier monochrome receiver.

To achieve this result, it is normally necessary to split the output of the IF channel, taking some of the



This diagram illustrates, in block schematic form, the various sections of a modern NTSC pattern receiver. Each block would normally involve several valve stages, some quite complex in their operation.

signal to the FM sound discriminator, from which it passes to the audio system.

The rest of the signal, however, is passed through filters, which are sharply tuned to reject the sound component, lying normally 4.5Mc above the video IF. In this way, the sound component and its FM sidebands are kept right out of the video detection circuit.

In practice, therefore, the tuning and IF system of a good quality color receiver is at present considerably more complex than that of a monochrome receiver, though, as previously suggested, pressure of research and mass production may serve to discover ways of achieving the desired results more simply.

VIDEO OUTPUT

The output from the video detector contains four sets of information, as under:

(1) "Brightness", more or less in line with conventional monochrome transmission.

(2) Chrominance information which has to be separately filtered out and decoded for ultimate use.

(3) Line and frame synchronising signals identical to those present on a monachrome transmission, and

(4) The chrominance sub-carrier synch. burst, accommodated on the "back porch", as described last month.

Considering first items (3) and (4), the line and frame synchronising pulses can be passed through the normal synch. separation circuits, thence through the respective amplifiers to the deflection yokes. This does not involve any special difficulty.

Item (4), the color burst signal, calls for the provision of special circuitry to separate it from the rest of the signals and put it to proper use. As indicated last month, the purpose of this signal is to provide a reference whereby the receiver can incorporate a 3.58 Mc. oscillator operating exactly in phase with the sub-carrier generator in the transmitter.

To this end, the receiver incorporates a special "burst gate" circuit which responds only to the appropriate sample of the sub-carrier on the "back porch" of the transmitted signal.

In its simplest form, this "burst gate" involves an amplifier valve with a 3.58Mc load in its plate circuit but with the grid or suppressor normally held well beyond cut-off.

Matters are arranged, however, for the valve to be triggered into operation by the line synchronising pulse, generally with a delay of three or four microseconds.

RECEIVES "SAMPLE"

This means that the valve becomes active just at the right time and for just long enough to amplify the eight cycles of chrominance carrier "sample".

This "sample" is applied to a phase detector system and thence to a reactance tube, coupled across an in-built crystal controlled oscillator circuit. Any discrepancy between the phase of this local oscillator and that of the sample burst, produces an output from the phase detector, which operates through the reactance tube to vary the crystal oscillator frequency in the right direction.

It is, in point of fact, a much refined version of the automatic frequency control circuit sometimes used in elaborate broadcast receivers.

At this stage, therefore, we can assume that the receiver has been provided with a highly accurate reference carrier for the chrominance signals, as well as the more usual vertical and horizontal sweep frequencies.

Returning now to the video signals, items (1) and (2), these appear in combination at the output of the video detector.

To achieve the appropriate separation, the output of the video detector is fed into two separate filter systems.

The first is arranged to pass all frequencies adjacent to the video IF, tapering off in its response only when it approaches the chrominance sub-carrier region 3.58 Mc away. The output from this filter system is then available as a brightness signal for the picture tube. It corresponds to the quantity "Ey" at the transmitter. (See previous issues.)

In point of fact, this brightness signal may need to be artificially delayed on its way to the picture tube, in order to keep it in exact time relationship to the chrominance signals which reach the tube through more devious paths.

Such time delay is normally provided by the "delay line" technique, simulated by carefully chosen lumped inductors and capacitors.

The circuits which handle the chrominance signals are the real heart of a color TV receiver and the source of most of its complexity. For the present, it must be sufficient merely to state the function of these circuits without trying to analyse their operation in detail.

CHROMINANCE SIGNALS

The chrominance signals are separated by applying the total video signal to a band-pass filter, which is centred 3.58 Mc above the video IF. It, therefore, completely rejects all frequencies approaching the nominal video IF as well as signals higher in frequency, which pertain to the sound carrier.

Most of the signal content which passes through this filter represents sideband energy from the modulated chrominance sub-carrier.

As we have seen, the sub-carrier itself was suppressed at the transmitter, but it is effectively restored in the receiver by reintroducing some of the output from the receiver's own sub-carrier oscillator.

In other words, the net product of this part of the circuit is a duplicate of the chrominance information generated at the transmitting end.

However, as might be obvious, the receiver has to reverse the procedure of the transmitting circuits. Instead of a series of balanced modulators, each delayed in sub-carrier phase with respect to the other, the receiver substitutes a series of phase detectors, supplied with differently delayed versions of the locally generated chrominance carrier.

From the detectors emerge the color difference signals as originally generated at the transmitter.

Again reversing the procedure, the receiver then combines the red, the blue and the total brightness values to recover a green signal. As previously mentioned, this procedure involves merely an elaboration of the audio mixing technique, whereby signals can be added in specific proportions, or even made to cancel by reversing the phase of a particular component before "mixing".

The net result, however, is that, from all this, the receiver ultimately obtains color difference signals "Er-Ey", "Eg-Ey", and "Eb-Ey". These are—or should be—exactly similar to the equivalent color difference signals at the transmitter. In addition, the receiver also has available the brightness signal "Ey".

At this juncture, the whole purpose of the color difference signal becomes obvious.

"COLOR" VOLTAGES

By simple mathematics, if we add the quantities "Ey" and "Er-Ey", the answer is simply "Er", and this is the signal voltage proportional to red.

By a similar process, the combination of the brightness and color difference signals for green and blue give the signal voltages "Eg" and "Eb", which are what we require to activate the guns of a tricolor picture tube.

The combination of voltages to produce Er, Eg and Eb can be accomplished in various ways and with varying degrees of complexity. Some of the more elaborate receiver designs provide special mixing circuits on the grounds that such circuits repay their complexity by giving a better picture.

Other receivers use simpler systems which rely to a greater extent on a mixing action within the picture tube itself. Thus, by applying the brightness signal to the intensity grids and the respective color difference signals to the separate cathodes of tricolor tubes. the "Ey" component can be made to cancel because it represents an equal but contradictory signal on the grid and cathode.

The direct color components Er, Eg and Eb, suffer no such cancellation and remain as separate and distinct color signals.

In practice, due to the operation of the filter circuits in the transmitter, all three guns tend to act together on the high frequency video components, and, therefore, tend to produce a monochrome outline for the finer details of the picture.

COLOR PATCHES

The guns act separately, however, for the lower video frequencies, thereby filling in the color patches to a degree of detail necessary to produce an acceptable picture.

It is not proposed at this stage to repeat our explanation of how the various color tubes work. An article on this subject appeared earlier in the series, notably in the October, 1952, issue.

Two other special points need to be made to complete this explanation of color receivers.

The tricolor tubes at present in use have substantially flat faces and a flat structure for the color masks. As a result, the beam has to travel over greater distances near the confines of the picture than it does near the centre. This normally leads to distortion, defocusing and color degradation.

To limit these effects, it has proved necessary to provide dynamic correction for both deflection and focus. For this purpose, signals are extracted from both the vertical and

(Continued on Page 111)

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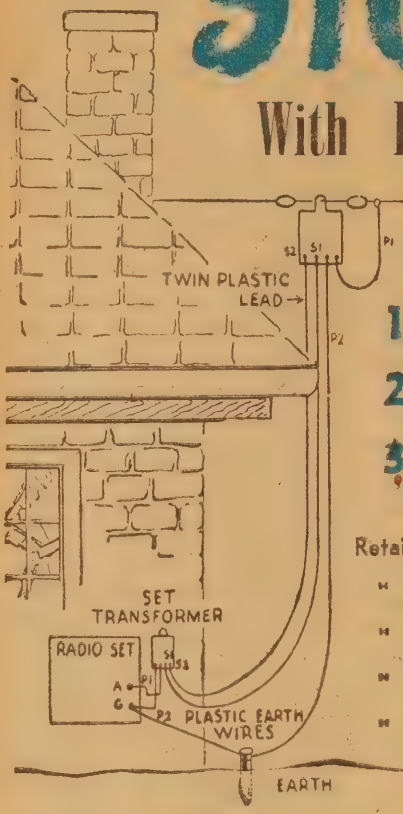

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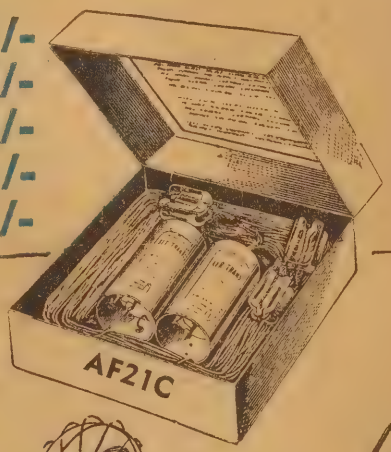
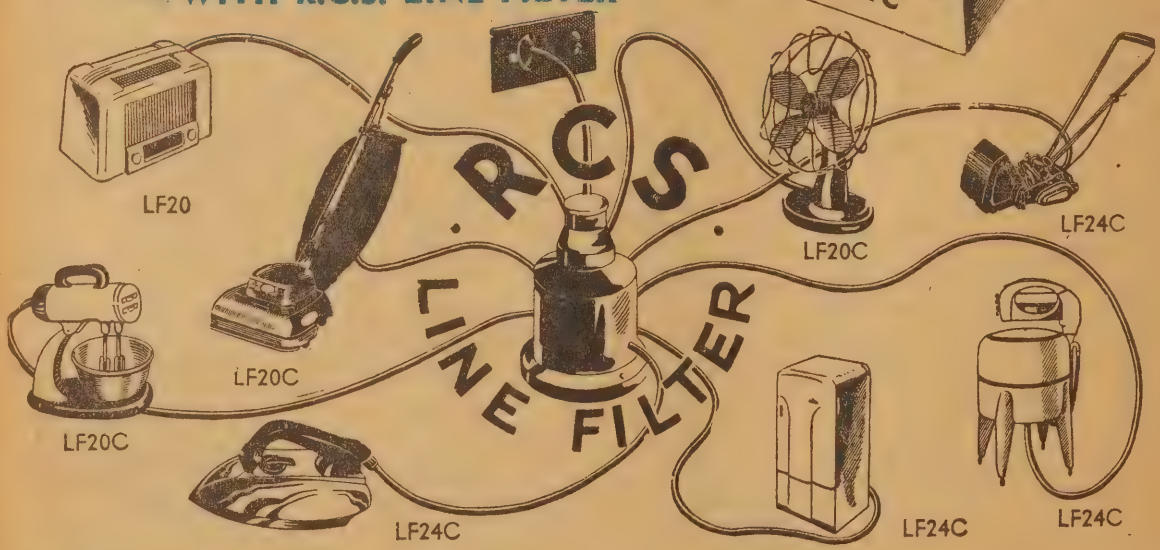


CONFINE NOISE WHERE IT STARTS — WITH R.C.S. LINE FILTER



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EARTH'S STRUCTURE

(Continued from Page 11)

small to be taken as proof that the currents, if they actually exist, are decaying.

To meet this problem of constant current flow, the idea has been advanced that they are maintained by electromotive forces which are induced by the convective movement of the material in the molten core as the earth slowly cools down (see Fig. 6).

Recently, the hypothesis has been advanced that magnetism is a fundamental property of rotating matter, being related to the mass and speed of rotation of the body. So that a body of certain dimensions should have a magnetic field strength on its surface which is proportional, to its speed of rotation and its mass and which decreases continuously from the surface to the centre of rotation of the body. Measurements made in mine shafts and caves showed that the earth's magnetic field decreased with depth, whereas, if the magnetic core or current flow hypothesis were true it should increase as toward the centre of the earth.

The evidence thus obtained was, therefore, interpreted in favor of the fundamental property hypothesis, but later studies on magnetism have shown that for most stars the strength of the magnetic field is continuously changing, whereas, the direction and velocity of rotation remain the same.

The size of the earth and the conditions that exist in its interior make it a valuable and virtually inexhaustible source of power.

At present, we have no means of penetrating the solid, rock-like crust to an extent sufficient to draw fully upon the energy reserves in the inside of the earth, but there is every hope that this might be accomplished in the future. Could we but penetrate to the liquid core, there exists the possibility of using directly the electrical energy which many people hold to be the cause of earth's magnetism. Truly we have buried treasure beneath our feet!

MODEL SHIPS

(Continued from Page 23)

is used to control the deflection of a pen on a polar recorder, the turntable of which is rotated in synchronism with the revolving model.

Signal-strength amplitude is plotted as a function of bearing. This plot is a characteristic of the ship antenna and is applicable whether the antenna is used for transmitting or receiving.

Ground plane and turntable were designed to eliminate variances in directivity patterns caused by discontinuities within the field. Periphery of the field is sharply scalloped to reduce standing waves, which might be produced by reflections from the outer edge.

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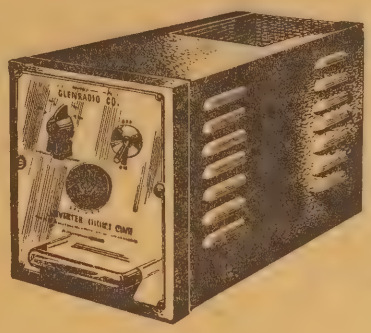

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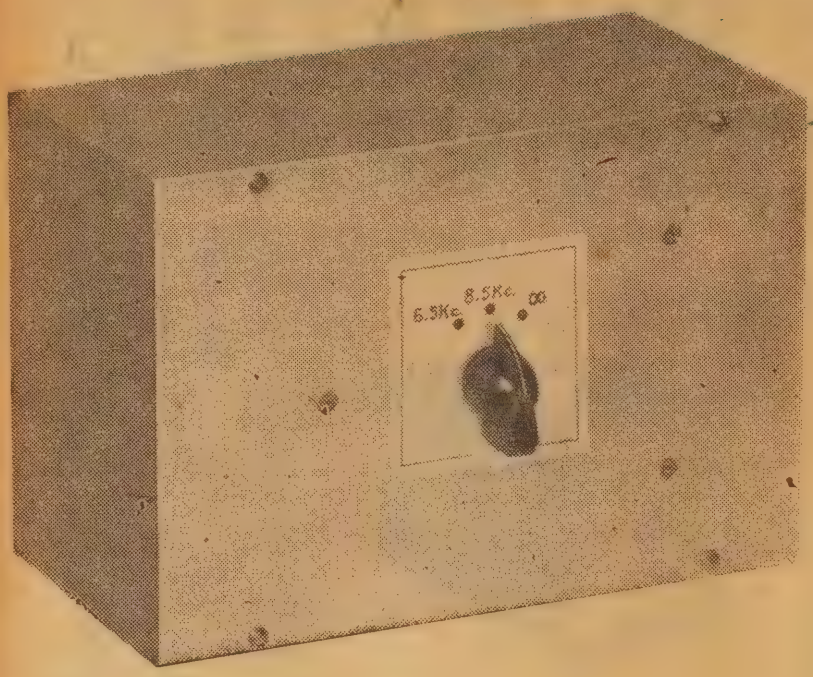


The complete 15-ohm voice coil filter unit installed in a lacquered wooden box. Whether this is located near the speaker or the amplifier control unit must be a matter for individual choice.

SPEAKER VOICE COIL FILTERS

Despite earlier articles published on the subject, one of the most frequent requests made through our query service is for information on the construction of voice coil filter units. We plan to anticipate further inquiries by re-stating the earlier information, together with additional notes on filters for 8 and 2-ohm circuits.

by W. N. Williams

READER interest in treble-cut filter circuits has foliowed the quantity release of speakers capable of reproducing, without serious attenuation, frequencies up to about 15Kc.

Having bought and installed such speakers, audio enthusiasts discovered, not only their ability to reproduce good programs extremely well, but also their ability to reproduce distortion and noise that had hitherto remained unnoticed in the more dubious programs and records.

Direct broadcasts, tapes and microgroove records generally sounded well, but special difficulties arose:

(1) With whistles and "chatter" in wide-range tuners under poor conditions, and

(2) With bad distortion from all but the best 78 rpm records, especially when played with mediocre domestic pickups.

RATTLES AND BUZZES

In this latter case, the distortion is often most distressing, having a "rattling" or a "buzzing" quality that is not unlike a cone fault in the speaker or the product of parasitic oscillation in the amplifier.

In fact, such things have quite frequently been blamed for the distortion and, while they may be occasional and contributing factors, the user has gradually come to realise that the trouble has more to do with the program source than it has to do with the equipment.

Poor radio programs and more particularly old records, are simply not good enough for modern equipment. Their inherent noise and high distortion become painfully obvious when not masked by limited response in the amplifier and speaker system.

For this very reason, audio enthusiasts are gradually discarding their old record libraries and replacing them with those microgrooves which have gained the reputation of being "clean"

Such, briefly, is the case for using a top-cut filter of one kind or another.

In the matter of approach, experience has shown that a gradual cut-off, as given by ordinary treble-tone controls, is not the best solution to the problem. A setting which gives adequate attenuation of extreme frequencies is likely to cut the middle register more severely than necessary and to sound needlessly dull in comparison with better quality programs.

A much better approach is to provide a network which will give a very sharp roll-off above a selected frequency, leaving other frequencies more or less unaffected. Such networks are frequently used in broadcast stations to limit the noise and distortion from poor discs.

A roll-off frequency of 6.5Kc is commonly chosen as a good all-round compromise.

It is entirely possible to evolve filter networks which give a wide selection of roll-off frequencies and which even allow the rate of attenuation to be varied beyond the nominal cut-off point.

However, such networks are generally quite complex in their construction and likewise in their use. After an initial period of "fiddling",

DETAILS OF V/C FILTER AND INDUCTOR BOBBINS

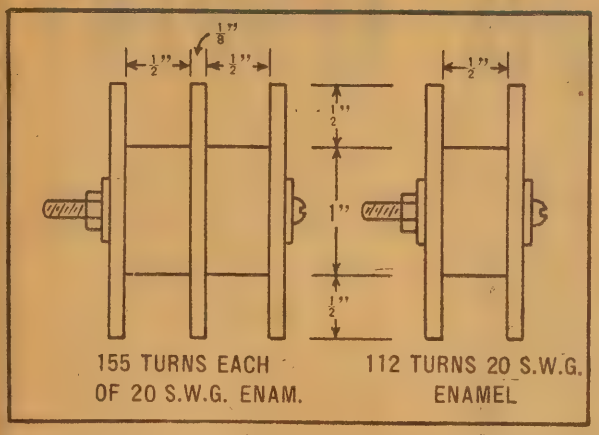
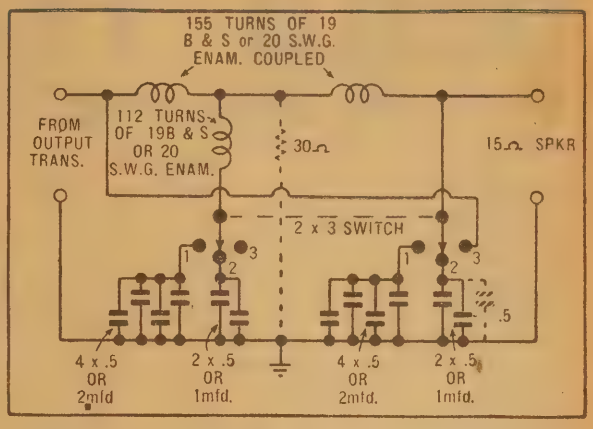


Figure 1: All coils are wound on bobbins of the above dimensions except the 2-ohm filter in which the inside diameter is reduced to ¾in. A one pound reel of wire will be enough for any one complete filter.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112 TURNS OF 19B & S OR 20 S.W.G. ENAM.
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15Ω SPKR
2 x 3 SWITCH
1
2
3
.5
4 x .5 OR 2mfd
2 x .5 OR 1mfd.
4 x .5 OR 2mfd.
2 x .5 OR 1mfd.

Figure 2: The circuit diagram is identical in principle to units which have been described on previous occasions. It shows how the capacitance values can be built up from low voltage tubular capacitors. Note also the additional 30-ohm resistor.

enthusiasts tend to ignore most of the possible combinations and to favor one or two easily-recognisable settings.

THREE POSITIONS

After passing through just such a stage, we are nowadays prepared to settle for a filter with about three positions:

(1) "Open" with the filter switched completely out of circuit.

(2) Sharp-cut above about 8.5 kc. This largely eliminates heterodyne whistles and "monkey-chatter" from wide-range tuners, as well as most "groove" and "needle-fit" distortion from imperfect set-ups. The music still has very much a "wide-range" quality.

(3) Sharp cut above about 6.5 kc. This is for bad programs and most old 78 rpm records. The reproduction can still sound "bright", though lacking any real top response.

RC NETWORKS

Steps in between those suggested do not seem worthwhile in practice, while programs and records which demand a lower cut than 6.5 kc are hardly worth serious consideration. In many cases, too, cut-off frequencies lower than 6.5 kc are difficult to provide, by reason of the capacitance values required in the filter.

Sharp cut-off filters commonly use either multi-section R/C or L/C networks.

Resistance/capacitance networks have the advantage that the components are readily available and capable of measurement on a simple R/C bridge. They do, however, suffer from a large "insertion loss", which means that the nominal voltage or power fed into the network is greatly reduced by the time it reaches the output terminals.

This means, in turn, that such networks must generally be built into the amplifier system and involve the use of an extra stage, both to compensate the loss of gain and to ensure that the networks operate from and into the correct circuit impedances.

This last point is a most important one, because filter networks will only work correctly when associated with proper circuit impedances. If this requirement is not observed, there is every chance that the "roll-off" will not occur as predicted, or, alternatively, that the response at other frequencies will become very "lumpy".

If a network designed for use with one impedance has to be suited to another, values of capacitance, resistance and/or inductance have to be scaled up and down, according to the published formulas which apply to that particular network.

While this presents no special difficulty to a radio engineer, it can be very baffling for a home constructor, who may wish to add such a filter to the existing amplifier. Quite apart from the difficulty of the actual values involved, there are the ever-present hazards of adding any stage to an existing unit — problems of space, hum level, instability, and so on.

In face of all this, we are not too keen about filter networks involving extra valves, although the first unit we ever described was an L/C filter of this general type. Significantly enough, it never achieved any great degree of popularity.

Fortunately, however, inductance/capacitance filters can be designed with a very small insertion loss, and we soon realised the possibility of translating the original R&H filter into values that could be installed directly into the speaker voice coil circuit.

Our efforts in this direction led to

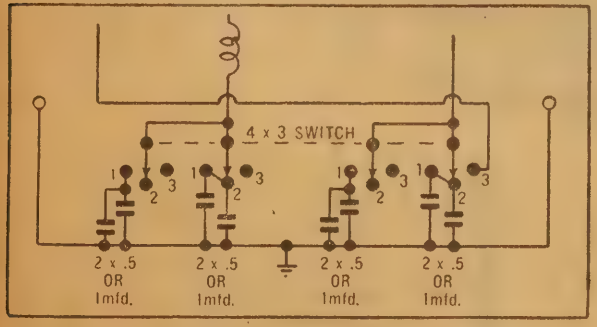

Figure 3: An alternative switching arrangement which uses a more complex switch but reduces the total number of tubular capacitors required.

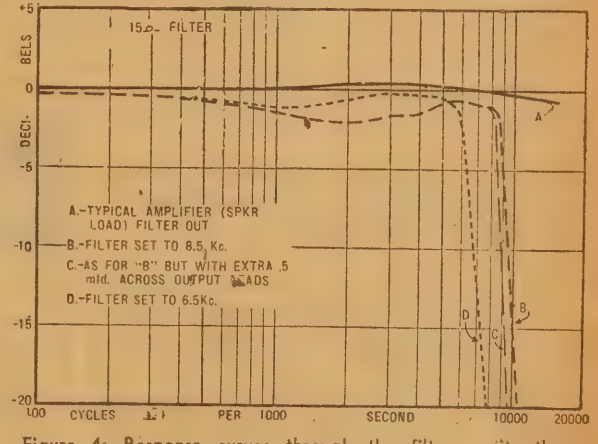

Figure 4: Response curves through the filter in its three different positions, taken with a typical amplifier and a 15-ohm voice coil load. Note how a slightly higher output capacitor can increase the attenuation in the 8.5 Kc position.

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- Vibra 5
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- Kit No. 6
- Kit No. 2
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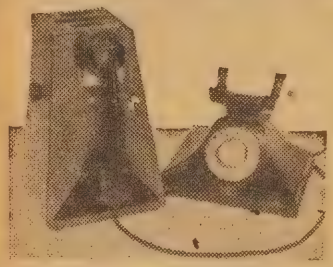
- 1952 Kar-Set
- 4 Valve Kar-Set 1953
- 6/240
- Intercom System
- Beginners' 1 Valver
- Two Unit Intercom
- Wide Band 7
- Trawler Converter
- Porta Player

etc, etc.



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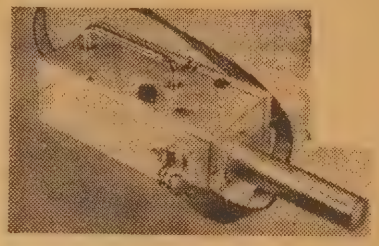

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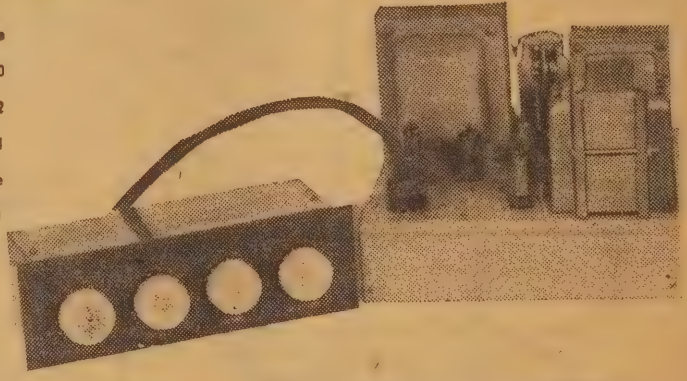

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the now very popular R & H Voice Coil Filter Unit, which solved the problem of the many listeners with imported 15-ohm voice coil speakers.

The values of capacitance necessary to match lower impedances, particularly 2.0 ohms, looked to be of such an order that we could only advise the use of a 15-ohm circuit and an auto-transformer to suit such speakers. (See Radio and Hobbies for January, 1950, June, 1952, and September, 1952.)

While this approach is still perfectly valid, and even necessary where a wide range of roll-off frequencies is required, we have done some further work which should materially assist the users of 8-ohm and 2-ohm speakers.

AN 8-OHM NETWORK

In fact, we have managed to produce a direct 8-ohm filter circuit, having the same nominal settings as our most recent 15-ohm units: "Open", "8.5Kc cut", and "6.5Kc cut". Elimination of the 4.5Kc position saves the embarrassment of having to provide 8 mfd paper capacitors.

Unfortunately, there can be no avoiding large capacitors when it comes to a 2-ohm circuit but, even here we have managed to evolve a useful 2-position filter system using no more than 8 mfd in each leg.

With an "Open" and a nominal "7Kc" position, it should be of particular assistance to the many users of 120X speakers. The "Open" position can be used on good programs and records, returning to the 7Kc roll-off position for poorer material.

We shall have more to say of these special cases at the end of the article. The first task is to describe the construction of a 15-ohm filter along lines already discussed.

The circuit is a rather unusual arrangement which does not conform to any of the usually published configurations. Its origin is rather obscure but for all its relative simplicity, it gives a very even response over the pass band and a very sharp and complete cut-off beyond it. Properly designed, the insertion loss is also quite low.

Coming then to the actual construction of a 15-ohm filter unit, the first job is to make up some bobbins to the exact dimensions shown in figure 1. You will need some plywood, bakelite or masonite for the cheeks and a scrap of broom handle for the bobbins.

MAKING BOBBINS

In making these items, we have found that the easiest way is to cut them to approximate size with a fret-saw and carefully drill a central 3-16 or 1-8in hole. If a short bolt and nut is locked into the hole, the piece can then be gripped in the chuck and spun with an electric drill.

By holding the drill in a drill-mount or large vise, the cheeks can be spun against the face of a coarse file and worked ito a good circle. Similar treatment with a scrap of sandpaper will round the edges and smooth the surfaces.

In the same way, the scraps of dowel can be partially parted off, lathe fashion, and the surface dressed. When finally assembled, a bobbin has a clean machine-made appearance.

The dimensions of the dowel and the thickness of the centre cheek in the double coil should comply with our diagrams so that the finished coil will duplicate the form factor and mutual coupling of the original.

The cheek diameter is not critical, however, although it must be sufficient to prevent the winding spilling over the edge.

WINDING COILS

The bobbins should finally be assembled on a single long bolt, preferably 1-8in or 3-16in brass, leaving enough thread exposed to attach them later to mounting brackets. Needless to say, metal cheeks should not be used and the coils should not be held flat against a metal chassis or a metal bracket large enough to produce a "shorted-turn" effect.

When it comes to winding the coils, every effort should be made to use the original wire, as specified, either 20 SWG or 19 B & S enamel.

We have assumed hand-winding with reasonable care. Thus, the start of each winding will be brought out through a small hole in the cheek, then the turns carefully wound for two or three layers. After this, the wire may begin to "lump" a little but continue to feed it on as smoothly as you can, keeping the surface layer reasonably level and avoiding rough back-and-forth movements.

The easy way of winding these coils is to grip the bobbin assembly bolt in the chuck of a breast drill, grip the drill in the bench vyce and run the wire on by turning the handle.

Be very careful, however, to make a prominent mark on the bobbin and carefully count each individual turn. If you do so, your coils will closely duplicate the originals and the response of the filter as a whole will not be adversely affected by any likely inaccuracy.

Enough of these filters have been

REAR VIEW OF FILTER UNIT

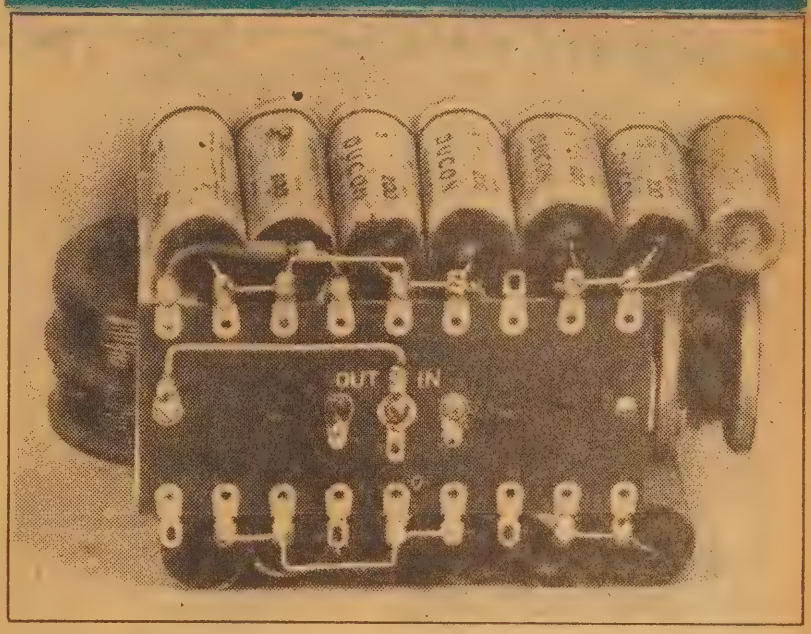

Figure 5: A rear view of the filter unit, showing how the tubular capacitors are mounted. The switch is not visible. The use of block capacitors would call for a different method of assembly but layout and lead lengths are not critical.

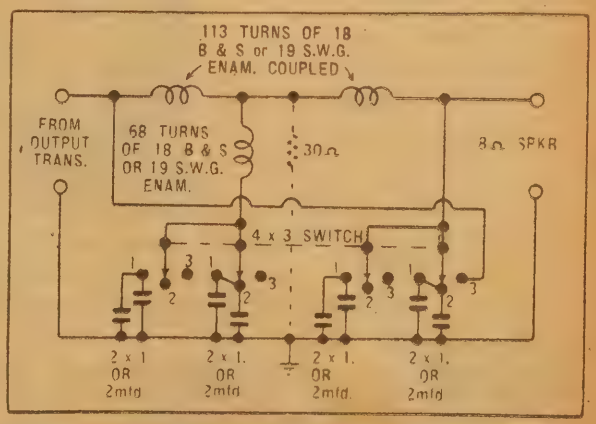
113 TURNS OF 18 B & S or 19 S.W.G. ENAM. COUPLED
FROM OUTPUT TRANS.
68 TURNS OF 18 B & S OR 19 S.W.G. ENAM.
30Ω
8Ω SPKR
4 x 3 SWITCH
2 x 1 OR 2mfd
2 x 1. OR 2mfd
2 x 1. OR 2mfd.
2 x 1. OR 2mfd

Figure 6: Here are the necessary details to construct a filter for 8-ohm circuits, as for the Rola 12UX speaker. Note the changes in wire gauge, number of turns and capacitance values.

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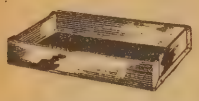

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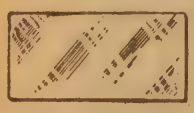

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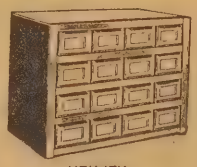

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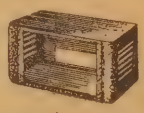

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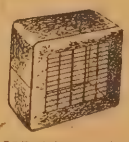

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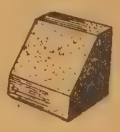

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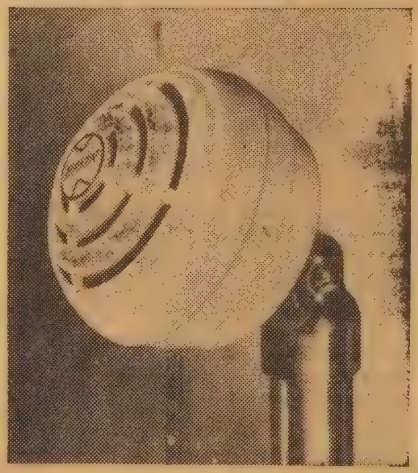

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made by various members of the staff, working only to published instructions, to indicate that there is no special difficulty about achieving the published results.

OTHER GAUGES

In a case of necessity, it may be permissible to wind the coils with slightly heavier or lighter wire than we have specified but the tolerance should not exceed one gauge either way. The main effect would probably be to shift the roll-off point slightly but hardly enough to warrant any adjustment to the number of turns.

When winding the twin coil, both windings should be put on in the same direction. The outside of one should then join to the inside of the other, this point in turn connecting to one end of the remaining coil, as indicated in the circuit.

Coming to the capacitors, we have managed to keep these down to the nominal values of 1.0 and 2.0 mfd. Provision of a 4.5 Kc roll-off would have involved the provision of 4.0 mfd capacitors as well, thereby greatly complicating the requirements.

On previous occasions, we have assumed that readers would "fossick" for oddment or block capacitors of the right values and this was quite permissible in days when disposals bargain tables were loaded with block capacitors for a few pence each.

The same approach is still quite permissible but we must add a word of warning that ageing capacitors are not always true to label. It is wise not to use them unless you can check them on a bridge for both capacitance and leakage.

In checking our stocks of oddment capacitors, we have frequently found them as much as 50 pc over value with bad leakage and power factor into the bargain. Such capacitors are better in the dustbin than on a shelf—let alone in a filter network!

Capacitors are normally made to a tolerance of plus or minus 20 pc, although 10 pc tolerance capacitors can usually be obtained on order from the manufacturers. While it is nice to have the more accurate values, obtaining them will certainly involve more time and money.

Most of the ordinary capacitors we have bridged from time to time seem to run about 10 pc high in value and the designs and curves which are given here are based on the use of such typical units.

ROLL-OFF FREQUENCY

The main effect of using capacitors slightly higher or lower than the originals will be to move the roll-off point bodily up or down by a few hundred cycles.

In rare cases, the combination of very high and very low capacitors in the respective legs of the filter, together with a similar inaccuracy in the coils, may cause the response curve to become somewhat lumpy or the roll-off to be more gradual.

This is a hazard which has to be accepted and corrected, where testing is possible, by interchanging the capacitors or by shunting them with additional smaller values to obtain nearer to optimum results.

Apart from capacitors you may obtain from disposals sources, local

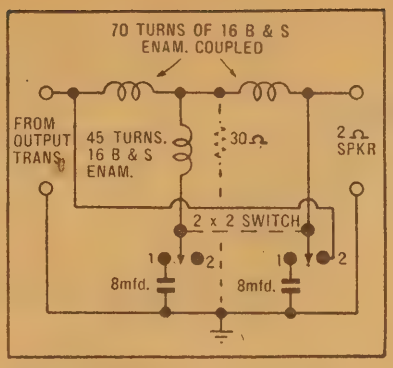

Figure 7: This 2-ohm filter is specially suitable for the Rola 120X speaker. It only has two positions, to simplify capacitor problems but should cover most requirements. It avoids the need for auto transformers, as suggested in earlier issues.

manufacturers make tubular types in 200-volt ratings up to 1.0 mfd. Can types, though more expensive, can be had in a 125-volt rating up to very much higher values than this again. Such capacitors are not normally carried in radio stores but your supplier will be able to get them for you if you can induce him to take the necessary trouble.

If you can't be bothered chasing special components, almost any radio store will be able to supply you with 0.5 mfd tubulars and these are a perfectly practical proposition for a 15-ohm filter.

To illustrate their use, we have drawn the first circuit, figure 2, so that it shows the total capacitance required for each switch position, together with the grouping of 0.5 mfd tubulars necessary to achieve it.

As you will note, it calls for 12 capacitors in all — or their equivalent in larger values—and a simple 2-pole, 3-position switch.

LAYOUT

By the use of a 4-pole 3-position switch, the number of capacitors required can be cut down to eight. Such switches are available in the "Jabel" pattern as single-deck units but two decks would normally be required in other brands to give the required number of circuits.

Figure 3 shows the amended wiring arangement for a 4-pole switch

RADIO Amateurs!

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Band 1. 32 Mc/s to 12 Mc/s.
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Band 3. 4.5 Mc/s to 1.7 Mc/s.
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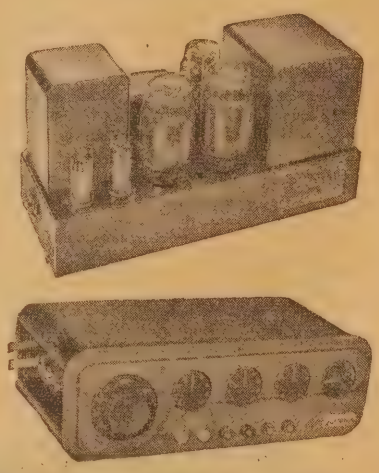

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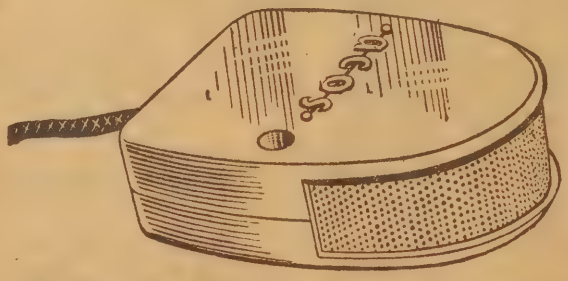

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Provided with built-in shunt resistance of 2 megohm giving response substantially flat from 50/5,000 cps. Resistance of the input circuit will reduce the low frequency response. A grid leak of ¼ megohm will reduce the output at 500 cps by 3 dbs and pro rata at lower frequencies.

Approximate capacitance of the microphone is 750pF and cable capacitance will reduce output proportionately.

Frequency response	**Substantially flat from 50/5,000 cps.**
Output level	**= 55 db ref. 1 volt/dyne/cm2.**
Load resistance	**2 megohms included.**
Cable	**This microphone is supplied with approximately 4ft. (1.2 metres of co-axial cable (type Unirad 32).**
Weight	**Microphone only — 6oz. (approx. 170 grammes) complete with packing 7oz. (approx. 198 grammes).**
Dimensions	**Microphone only 2 7/8in x 2 1/8in x 7/8in plus cable. Complete with packing 3 3/8in x 2¼in x 2¼in.**

Australian Agents: AMPLION (A'sia) PTY. LTD. Sydney, N.S.W.

SPEAKER VOICE COIL FILTERS

(Continued from Page 47)

but, in terms of performance, it is identical with figure 2.

The mechanical layout you adopt for the unit is of no great consequence and should be determined by the requirements of your particular set-up. The assembly method shown in the photographs should, however, be adaptable for most purposes.

The double coil is mounted inside a simple U-bracket bent from ¼in aluminium strip, 2¾in deep by 2in wide with mounting feet turned outward for ½in.

The single coil attaches to a single ¼in aluminium strip, 2¾in long with ½in feet turned over at each end.

These two brackets carrying the coils are bolted to an aluminium panel measuring 7½in by 5in and their other ends support a strip of resistor panel 4½in long and carrying nine lugs per side. As you can see from the photograph, the tubular capacitors are ranged around the side of this panel, the lower ends being joined to an earthed busbar.

The switch, which cannot be seen in the photograph, occupies the space inside the structure and is centrally placed on the panel.

In point of fact, having bent and drilled the brackets, &c., we wired the entire unit and attached it to the panel only as a final operation.

WOODEN BOX

The completed unit was then mounted in a wooden box measuring 7½in by 5in by 3 5-8in overall, made from 3-8in plywood, undercoated and lacquered. In the back of this we cut a rectangle 2in by 1½in giving acess to the "out" and "in" circuits in the centre of the panel. These are merely solder lugs bolted in position, as shown, one being a common "earthy" terminal.

In this form, the control box can either be stood on top of the speaker or mounted inside the cabinet with only the control shaft protruding.

Alternatively, it can be mounted in the amplifier cabinet and the control grouped with the remaining knobs. In the writer's case, the unit is attached to the rear of the cabinet and the knob made to operate the switch through a suitable length of ¼in brass rod.

This, however, must be a matter for individual choice.

As previously intimated, the unit is designed to operate from an amplifier having low output impedance (either pentodes with feedback, or triodes) and feeding a 15-ohm voice coil circuit.

Under test, the unit gave excellent results with resistive load but tended to exhibit a 2 to 3db hump in the middle of the range with voice coil termination. While this is not a very serious matter, we determined to eliminate it if at all possible.

It transpired that resistive loading across almost any section of the network tended to flatten the rise in question but with varying effects also on the roll-off characteristic.

However, by connecting a relatively low value of resistor across the centre element, as shown, dotted, the response could be flattened as required over the centre of the range without in any way affecting the steepness of the roll-off.

The value does not appear to be very critical and anything from about 30 to 50 ohms will be found to have the desired effect.

A further point is that the resistor appears to make the whole network less critical, when working into a voice coil load, and small adjustments could be made to the roll-off frequency simply by increasing the capacitance of the output capacitor alone.

PERFORMANCE CURVES

All this is summarised by the curves shown in figure 4. Curve "A" is for the amplifier alone—a medium quality feedback job—feeding into a speaker load and with the filter switched out of circuit. The output was as measured across the speaker voice coil.

Curve "B" shows the response with the unit in the 8.5Kc position; the steepness of the cut-off is very evident.

On this occasion we have not centred the curve on 0db at 1000 cps, so that it indicates the insertion loss as well. This amounts to less than 2db at 1000 cps and represents a barely perceptible change in level. The absence of "lumps" in the curve is evident.

If the unit is to combat heterodyne whistles and "monkey chatter" on radio, more rejection may be desirable at 10Kc and this can be obtained very easily by increasing the 1.0 mfd output capacitor to 1.25 or 1.5 mfd as shown dotted in the circuit.

The response with a 1.5 mfd output capacitor is shown in curve "C".

Curve "D" indicates the response with the switch in the "6.5Kc" position. If individual constructors wish to push this roll-off a little further down the scale, it can be done very simply by increasing the values of both capacitor blocks from 2 mfd to 3 mfd or thereabouts.

OTHER VALUES

This filter, by the way, could be used with 12 or 13 ohm speakers but, as before, its performance with 8-ohm speakers was not the best, either in respect to smoothness of response or insertion loss. What could we do to assist users of the 12UX, for example?

Suiting the thought to the deed, we found that we could re-design the coils approximately to halve their inductance, stepping up the wire by one gauge (either 18 B&S or 19 SWG) so as to occupy roughly the same amount of bobbin space. The lower resistance would also correct the insertion loss.

By doubling the capacitance values, we reckoned that the same two roll-off points would be achieved as in the 15-ohm filter. This called for total values of either 2 mfd or 4 mfd from either leg to earth.

A search around the radio stores brought to light some 1.0 mfd 200-volt tubulars, as already mentioned and eight of these gave us the complete 8-ohm filter unit as in figure 6.

A little further pruning of the coils was necessary to match up with the capacitors (again about 10 pc high) and to give us the results we wanted. For all intents and purposes, the final curves were identical with those of figure 4.

Physically, the unit was constructed in the same fashion as already outlined for the 15-ohm filter except that the panel size had to be increased slightly to 7½in x 5 3-8in.

If you wish to build this unit but use 2 and 4 mfd block capacitors instead of the tubulars, the switching would normally be amended to the simpler arrangement as in figure 2.

There would be the additional possibility of using a more complex switch to connect the block capacitors either singly or in parallel. This would connect either 2, 4 or 6 mfd into circuit and give an additional roll-off position at about 5.5Kc. Considering the additional complexity, it may not be worth while, however.

Encouraged by results with the 8-ohm filter, we had another look at the 2-ohm proposition. On the surface it called for a fourfold reduction of inductance and an increase in capacitance values to 8 and 16 mfd. Since electrolytics could not seriously be considered, we felt that most readers would baulk at the prospect of having to find that much "paper" capacitance.

Perhaps we could compromise?

To cut a long story short we reckoned that 120X users would be helped over most of their difficulties if they could have just a two-position filter—"Open" for good records and a cut at about 7Kc for the poor ones.

TWO POSITIONS

If we could settle for this and for the use of 8 mfd capacitors in each leg of the filter, then we might be able to "steer" the coils to give a suitable overall characteristic.

Since ohmic loss in the filter had to be kept to a minimum, we had to go to 16B&S enamel and reduce the bobbin diameter to ¾in instead of 1in. The rest of the detail is given in the circuit.

The capacitors values could be made up from disposals' units or bought new, according to your "junk" resources and finance.

On test, the 2-ohm unit isn't quite as sharp as the other two and the insertion loss is a trifle higher but, for all that, it should solve the immediate problems of the many readers at present using the 120X. The response rolls off just around 7 Kc but it can be moved upward a little in the range by reducing the value of the capacitance in series with the centre coil from 8 mfd to about 6 mfd.

PARAMOUNT ANNOUNCES NEW FILMING PROCESS

(Continued from Page 21)

2/1 aspect ratio of the print on to a standard frame and will need to be projected through a special lens giving the correct expansion. Special lenses, adjustable over a wide range of expansion ratios, are now available. (See Radio and Hobbies, July, 1954.)

The main advantage for this approach is an increase in light on the screen, due to the fact that the full area of the projection aperture is used. This can result in an increase of up to 40 pc.

Summing up, Paramount claim that their system will serve every aspect of the motion picture industry and will, at one and the same time, make it unnecessary for anyone to change any equipment if they don't want to, yet provide maximum scope for those who can afford to go the limit.

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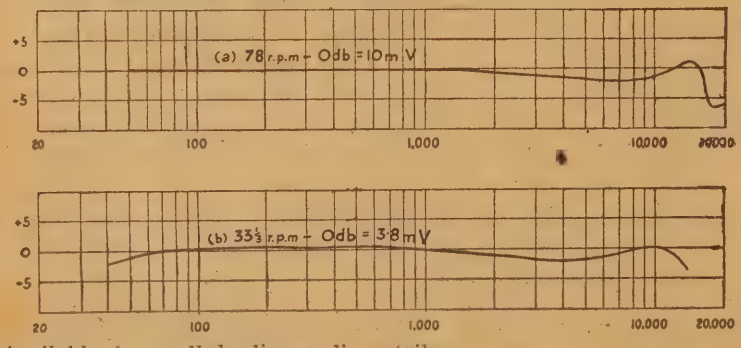

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The No. 500 operates on the variable reluctance principle, the magnetic circuit incorporating two main air-gaps, in each of which a cantilever arm carrying a jewel stylus is positioned. The two styli are located on opposite sides of the cartridge case, one being intended for use on 78 r.p.m. records and the other on microgroove records, and a simple mounting mechanism enables the cartridge to be rotated through 180 deg. in order to bring the correct stylus in position on the record.
The two styli are mechanically independent of each other; thus the mass of the idle stylus does not enter into the vibrating system, and a performance equal to that given by single purpose pick-up heads is obtained whilst the utility feature of the turn-over principle is retained. The styli are independently replaceable with ease by the user. The replacement of styli is not critical and no damage or maladjustment can result from the operation since the stylus itself is the only moving part of the system.

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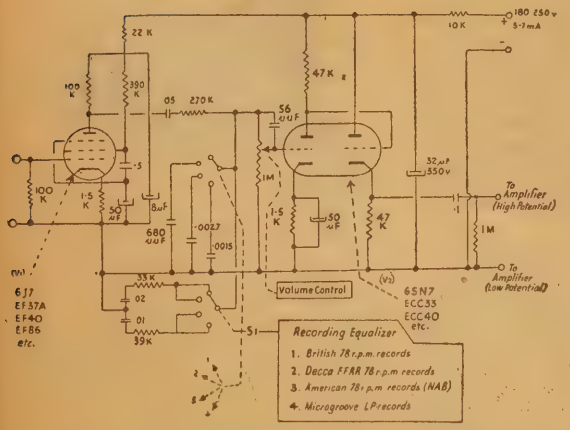

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SPECIFICATIONS
No. 500 CARTRIDGE

Type: Magnetic variable-reluctance turn-over cartridge.
Styli: (1) .0025 in. rad. sapphire for 78 r.p.m. (green).
Styli: (2) .001 in. rad. sapphire for microgroove (red).
Normal tracking pressure : 7 grams.
Lateral compliance : Not less than 5 x 10—6 cm/dyne.
Effective mass at stylus tip : 5 milligrams approx.
Output (average) : 3.2 mV per cm/sec.
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Impedance : 8,500 ohms at 1,000 cps.
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Here's your answer, Tom!

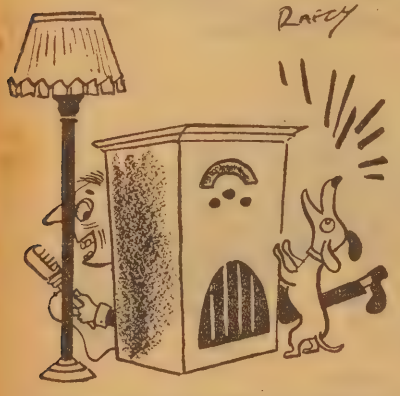
Most of Tom's questions this month come from a reader in Victoria. He modestly suggests that we might only be able to answer one per month but, since they are all good questions, we're going to answer them in a batch.

HIS first one is a very common one for beginners to ask:

I was thinking of using a headphone as a microphone. For the most sensitive type, what are the number of ohms I should use?

Headphones never sound very impressive as microphones, Tom, the quality generally being very thin and "metallic". However, there is no harm in trying it out for yourself, if you have one on hand.

As far as sensitivity is concerned, the rule of thumb is simply "the higher the resistance the better". High resistance phones will normally have more turns of wire on the bobbins and will, therefore, deliver a higher signal voltage when coupled to an amplifier input circuit.



The highest resistance phone you are likely to find will be about 2000 ohms. Lower resistance values will give progressively lower output.

Whether you will be able to get enough signal from even the best of them, however, depends on the gain of your amplifier. There would be no doubt about results from a proper "microphone" channel, but the gain available through the "pick-up" terminals of an ordinary set is very limited.

TRY IT AND SEE!

By all means try it, but don't be surprised if you have to speak pretty loudly into the phone to get any output at all from the set.

If you do have access to a high gain amplifier, Tom, don't forget that the earphone may have to couple to it through a length of shielded wire, otherwise you are likely to run into severe hum and oscillation trouble.

Don't forget, too, that you may not be able to operate the headphone mic. close to the speaker, otherwise the whole set-up will howl unmercifully, much to the dismay of your womenfolk and/or the household dog!

As a general rule, the connecting leads should be long enough to allow the microphone and speaker to be in different rooms, thus avoiding this acoustic feedback.

Are permag. speakers better than the field coil type? If so, why?

You simply can't answer a question like that with a simple "Yes" or "No," Tom. The best one can say is that they are the more popular at the moment, and possibly a better all-round proposition.

There was a time when permagnetic speakers were more difficult and more costly to make and somewhat less efficient acoustically than their electro-dynamic equivalents.

As a result, they were seldom used in anything but battery sets, for which they were an obvious necessity. Electrodynamics were used in all other sets and matters were generally arranged so that the field coil, while being energised from the power supply, also served as a filter choke.

It was quite a handy arrangement.

More or less coinciding with the war period, copper wire became rather scarce and, at the same time, considerable progress was made in the manufacture of permanent magnets.

The use of special alloys allowed much greater figures of flux density to be obtained from smaller structures, while dustproofing and magnetisation after assembly solved most of the problems of magnetic particles fouling the gap. In fact, permagnetics began to outperform the electrodynamics.

POPULAR PERMAGS.

After the war, when local receiver production got under way again, permagnetic type speakers were thus adopted almost universally for receivers and amplifiers. This position has remained unchanged ever since.

The disappearance of the field coil has naturally led to change in power supply specifications, Tom. Small mantel sets now commonly use only resistance/capacitance filtering, with rather larger capacitors than formerly.

Console receivers use a simple filter choke and more elaborate receivers and amplifiers use two chokes where previously they may have used one choke and a field coil.

In all cases, however, the transformer voltage can now afford to be lower and this leads to a saving in transformer cost and fewer breakdowns by overloaded electrolytics — which is all to the good!

Do wireless waves travel underwater? If not, how do they manage to communicate with submarines?

Strangely enough, Tom somebody else asked us this very same question a few days ago. As a matter of interest, we put it to several radio friends and none of them were too sure about the answer. Finally, we asked somebody who had been connected with navy communications and, as one might have expected, he was a lot more definite in his statements.

The fact of the matter is that ordinary radio waves suffer very rapid attentuation under water and, for all practical purposes, one can say that radio transmission is virtually impossible to or from submarines or submarine locations.

Using ordinary radio techniques,

relatively enormous powers would be necessary to transmit a useful signal over more than a few yards.

Navy under-water communication is based at present on supersonic principles. Small but powerful diaphragms, oscillating at frequencies above the audible range, impart actual mechanical vibration to the water.

These vibrations can travel over fair distances — say up to a mile or so — and be picked up by other devices not unlike an ordinary microphone. By coding or modulating this supersonic "carrier", messages can

be sent fairly easily to or from submarines.

Being ordinary radio engineers, we've never had occasion to dabble with this kind of thing but we trust this summary of the situation isn't too far off the beam, Tom.

Is using the sea as an "earth" for wireless a good idea? If so, how is it done?

For radio purposes, Tom, the ocean is a very good "earth" indeed. Fresh water, as in rivers, isn't as good a conductor in terms of ordinary direct current, but we cannot recall having seen a discussion on whether ship's transmission is in any way affected by fresh or salt water conditions. We hardly think it would be.

In any case, it might be rather hard to decide, Tom, because fresh water only occurs in rather land-locked situations and it might be difficult to decide whether radio transmissions are being affected by the surrounding land.

STEEL SHIPS

With steel ships, the hull naturally makes contact with the surrounding water and also serves as an "earth" return for all the radio and electrical gear aboard. With a large ship, the hull itself would be a pretty effective earth or "counterpoise" anyway, irrespective of where it was.

From a radioman's point of view, the difficulty of proving or disproving such ideas lies in the problem of transporting a large ship to possible test sites.

The owners of the Queen Mary would probably not take very kindly to the idea of having it transported bodily overland to one of Canada's freshwater lakes, or trundled off into the middle of the Sahara desert!

However, Tom, if your interest lies in small ships, which we landlubbers simply refer to as "wooden boats", the general idea seems to be to provide them with a copper sheath on the keel. This gives a certain amount of mechanical protection to the keel and a wire connected to it likewise provides an excellent "earth" return for the radio gear.

Do wireless waves go underground? If so, how far do they penetrate?

There's no doubt about it, Tom, you're raking up some unusual questions for us this time.

As in the case of seawater, the attenuation of radio waves travelling through soil is very rapid. Naturally it varies a good deal between types of soil and rock, and with the amount of moisture present.

However, as you can easily discover with an ordinary portable set, radio programs soon fade out once you get a few feet of soil between you and the outside world.

Don't forget, of course, that radio waves can still come in the same way as you did and you may be able to hear signals quite well inside an open-mouthed cave. But they can't turn corners as well as you can and it isn't very hard to lose them down a winding underground passageway.

If I built a room underground for wireless experimental purposes, would this be the solution to static, noises, &c.? If so, how far down should I go?

Ah, now we see what you're getting at! Up till now, the whole trend of your questions seemed to indicate that you were thinking of turning yourself into a radio recluse!

No, Tom, digging underground radio rooms won't solve your static and noise problems.

To be sure, if you get several feet underground and block off the entrance, you won't hear much static or noise — but you won't hear any signals either and that's not of much use.

To receive the signals, you would have to take an aerial lead down into your den and in would come all the noise and static as well. You see, noise and static are identical in character with radio waves and you can't block off one without the other. Neither can you lead one in without the other tagging along too!

If you really must have a room that will shut out all radio signals —noise and programs alike—there is a much easier way than digging a hole underground.

SCREENED ROOMS

We refer to a "screened room", as installed in most laboratories. You start off by building a complete skeleton framework for a portable room, preferably from about 3 x 2in or 2 x 2in softwood and equal to about a cube with 8 feet sides.

You then completely cover the outside (except for the doorway) with copper gauze or fine galvanised chicken wire, soldering along the joints.

The inside is likewise covered, but care taken to have no accidental connection between the two layers of wire.

The door has to be similarly covered and the edges bevelled and metal clad so that the two screens are maintained continuous when the door is closed.

When all this is finished, the floor and benches can be added.

The usual procedure is to bond the two shields at the point where the power mains enter, returning this point also to an effective earth. The incoming power lines should be filtered to prevent any ingress of signal along with the power.

A room like this will shut out all radio signals and noise, Tom, and is ideal for running sensitivity tests using a signal generator.

But, as we said earlier, it doesn't solve the static and noise problems relative to ordinary listening. The moment you take an aerial inside the cage, static, noise and radio signals all come streaming in together.

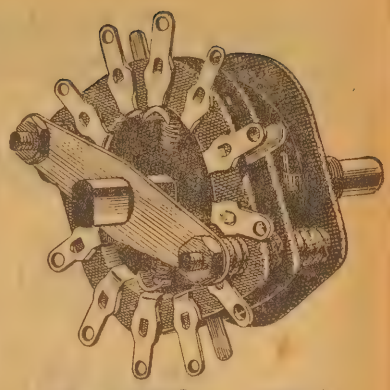
Is there a satisfactory way of testing coils to find which is the best?

Most definitely, Tom. In fact, there are several ways, but most of them, if not all, require access to laboratory equipment.

Probably the best known is by means of the so-called "Q-Meter" which is especially designed for the purpose.

As the name suggests, its main function is to measure the operating "Q" of the coil, which, along with a knowledge of its inductance and distributed capacitance, will give a very good lead as to how the unit will perform when ultimately wired into a receiver.

(Continued on Page 111)



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- **PICKUP/RADIO SWITCH:**
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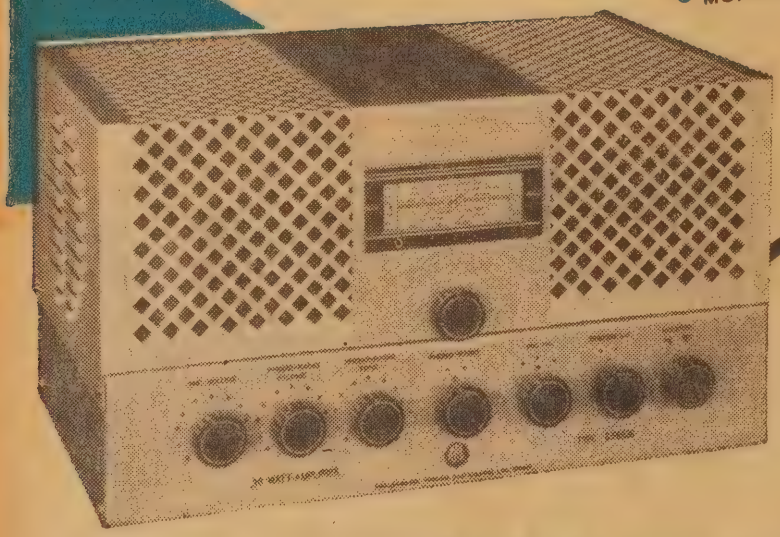
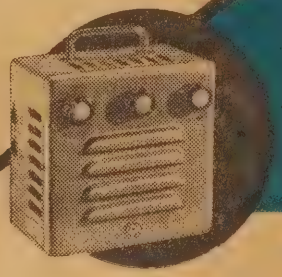
- **LOW FREQUENCY ATTENUATION CONTROL:** Provides approximately 10 db. attenuation at 50 cycles for feeding horn type speakers.
- **MONITOR ON/OFF SWITCH:**





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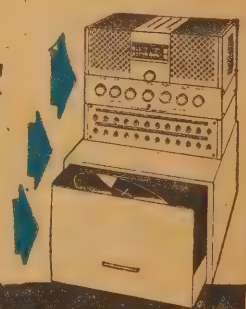

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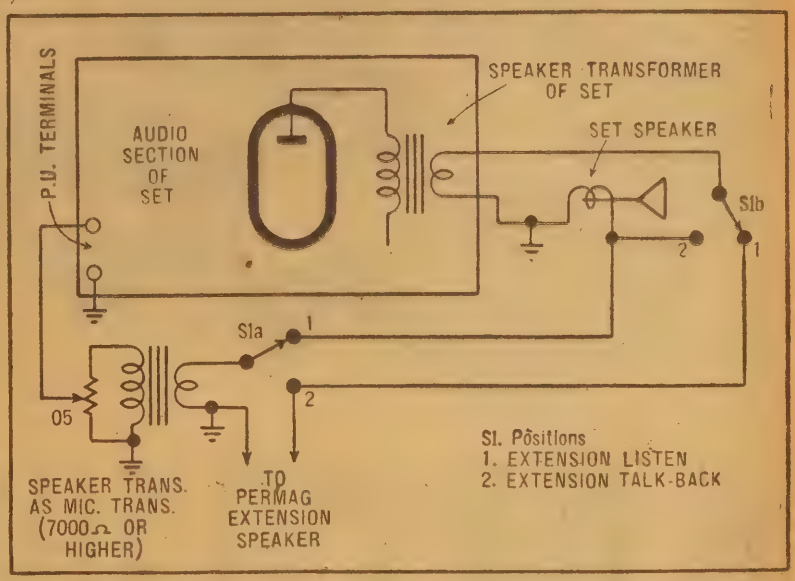
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

RADIO SET WITH EXTENSION TALK-BACK FACILITY

If you have a spare set, aged or otherwise, and a permagnetic speaker with transformer, you can put them to good use as a combination radio-extension and talk-back unit between rooms in the house or between the house and an outer building.



THIS idea was submitted by Mr. E. C. Watkins, of 67 Britannia St., North Beach, Christchurch, New Zealand. He says it has been used successfully between showrooms and workrooms some distance apart. When the talk-back facility is not being used, the radio produces music-while-you-work. In actual fact, our contributor converted an old console radio costing about £4.

The audio end of the set is used for the talk-back system. The second speaker transformer is mounted near the set and used as a microphone transformer for the extension permagnetic speaker. The actual position of mounting could be inside the cabinet sufficiently displaced from the power transformed to avoid hum pickup.

The .05 megohm volume control connected across the secondary winding can be mounted either on the chassis or near the transformer. This control is set to give optimum voice level from the main speaker, using the permagnetic extension speaker as a microphone with the volume control of the set in its "normal" position. Once set, it will probably need no further adjustment.

Connections between the .05 megohm control, the "microphone" transformer and the pickup terminals of the set should preferably be made in shielded wire to avoid hum pickup.

The connections from the voice coil winding of the set speaker transformer to the DPDT switch, the primary winding of the "microphone" transformer and the extension speaker can be made in unshielded wire because this part of the wiring is at low impedance.

FOR SHORT RUNS

For a reasonably short indoor extension run, twisted bell wire would be satisfactory. For outside runs or runs of some length, rubber or plastic-covered power flex would be more suitable from the point of view of weathering and lower DC resistance.

If, when all is completed, a loud howl or squeal is heard, reverse the connections to, say, the primary winding of the "microphone" transformer.

It is assumed that the set is provided with a radio/gramo changeover switch. This changes the system from the music-while-you-work function to the talk-back function. If the radio program facility is not desired, the audio end of the set can be used solely for the intercom purpose.

The switching actions can be summarised as follows: With the radio/gramo switch set to "radio", the program is fed to the extension speaker when the switch S1 is in position 1. With S1 in position 2, the program is fed to the set speaker.

If it is desired to call the remote point fed by the extension speaker, the radio/gramo switch is moved to the "gramo" position and the call made by speaking into the set speaker. At the conclusion of the call, the switch S1 is set to position 2 and the reply, spoken into the extension speaker, is heard at the set speaker.

It will be necessary to speak close to and into the cone of the speaker being used.

Control of the system is at the set end, and there is no provision for the extension to break into a radio program to call the set end. This may be quite satisfactory for some applications, but for those installations where such a facility is desired, a simple calling device would be a buzzer circuit employing a third wire working in conjunction with the common earth return. The bell-push would be mounted on the extension speaker box, and the cycle battery and a cheap buzzer mounted near the set speaker.

While a standard DPDT switch will carry out the necessary changes in circuitry, a more convenient switch for intercom. use would be a PMG type spring-return key switch.

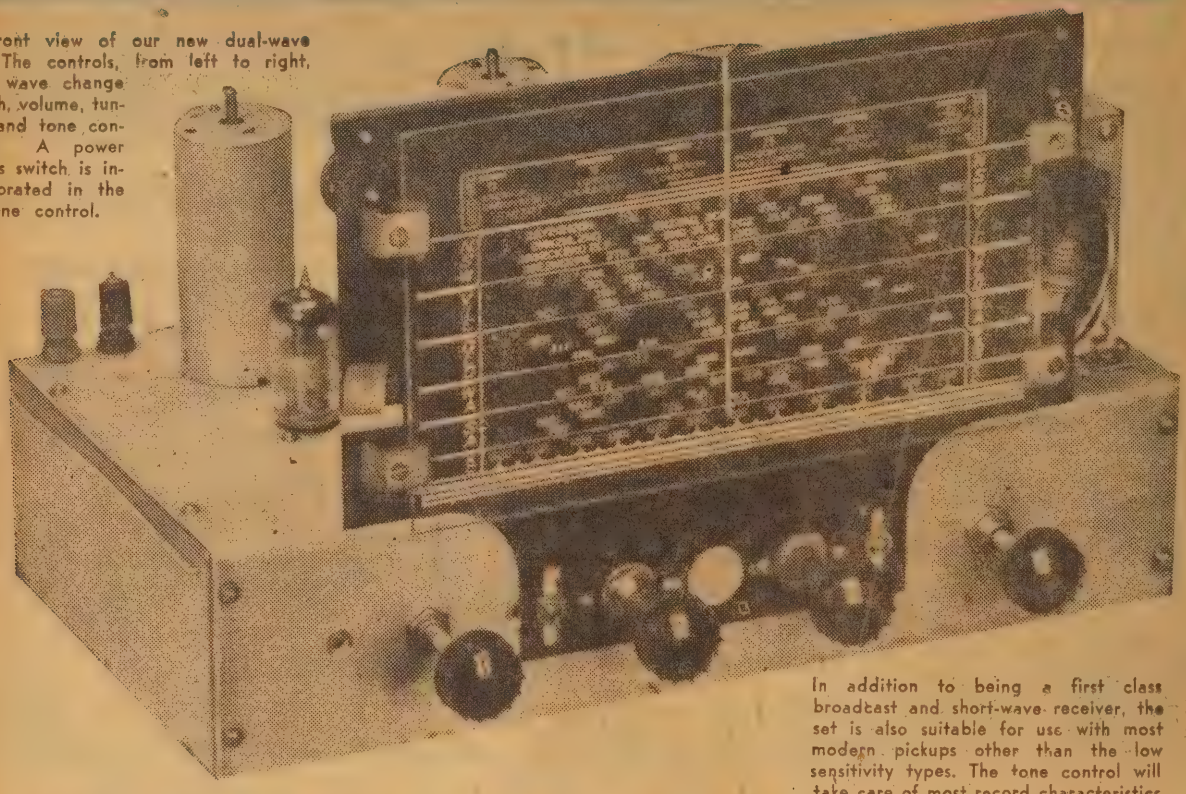
When in the centre or rest position, it should be wired to agree with S1 in position 2. In the spring-loaded or down position, it should agree with S1 in position 1.

The extension speaker could be fitted into a suitable box and mounted on a wall at about head height for convenience in replying to calls. The size of speaker is not critical, although a 7in or 8in would be about optimum.

AS A MIKE

Some thought will be necessary at the set end of the installation to provide for easy use of the speaker as a microphone. One idea would be to remove it from the cabinet and fit it into a wall-mounted box in the same manner as for the extension speaker. If this is done, it would be wise to remove the transformer from it and mount it on the chassis of the set to keep the output valve anode lead to a reasonable length. The low impedance voice coil winding can then be extended to the speaker voice coil connections without encountering instability.

Unfortunately, this "press-to-talk" action at the set end is not convenient for feeding radio program to the extension speaker, although a wire hook or clip to hold the press-to-talk switch in the down position may be quite satisfactory.



A front view of our new dual-wave set. The controls, from left to right, are: wave change switch, volume, tuning and tone control. A power mains switch is incorporated in the tone control.

In addition to being a first class broadcast and short-wave receiver, the set is also suitable for use with most modern pickups other than the low sensitivity types. The tone control will take care of most record characteristics.

THE DUAL-WAVE STANDARD FIVE

Here is the description of a dual-wave set that is capable of excellent results, yet is described in such a way that even the raw beginner should have no difficulty in making a first-class job of it. All complications in the coil switching section are avoided by the use of a ready-made bracket and the diagrams show the placement of all wires and components.

by Philip Watson

WHILE there is little doubt that the broadcast type five-valve set is one of the most popular at the present time, both as regards buyers and builders alike, it is almost equally certain that the dual-wave version runs it a very close second.

This is particularly so in the case of the home builder, probably because the kind of chap who is keen enough to build his own set is also keen enough to taken an intelligent interest in the various activities on the short-wave bands.

KEEN LISTENER

In this respect he has something of an edge on his non-technical counterpart, who is usually unable to appreciate the need for listening at the right time and on the right frequency.

Another point which is not always fully appreciated is that the short-wave section of the set is no longer merely a novelty to enable the owner to boast that he can listen to the other side of the world. Nowadays it can provide alternative channels for local programs, thus helping to solve the problem of reception in difficult localities.

The suburbanite is inclined to take the reception of his eight local stations very much for granted, and will probaby complain if even one of them fails to give him 100 pc service. On the other hand, most localities more than 100 miles or so from a capital city have more than their fair share of reception troubles.

If they are lucky they may come within the primary area of a regional transmitter and, perhaps, a local "B" class station. With a choice of two programs they are much better off than many, though still a long way short of a reasonable variety of program material.

If they are less fortunate, they may have no stations within a reasonable distance and are thus forced to make do with whatever programs happen to be audible above the general noise level. In really bad localities it is not unusual to experience an almost complete blackout of broadcast band signals during the summer months.

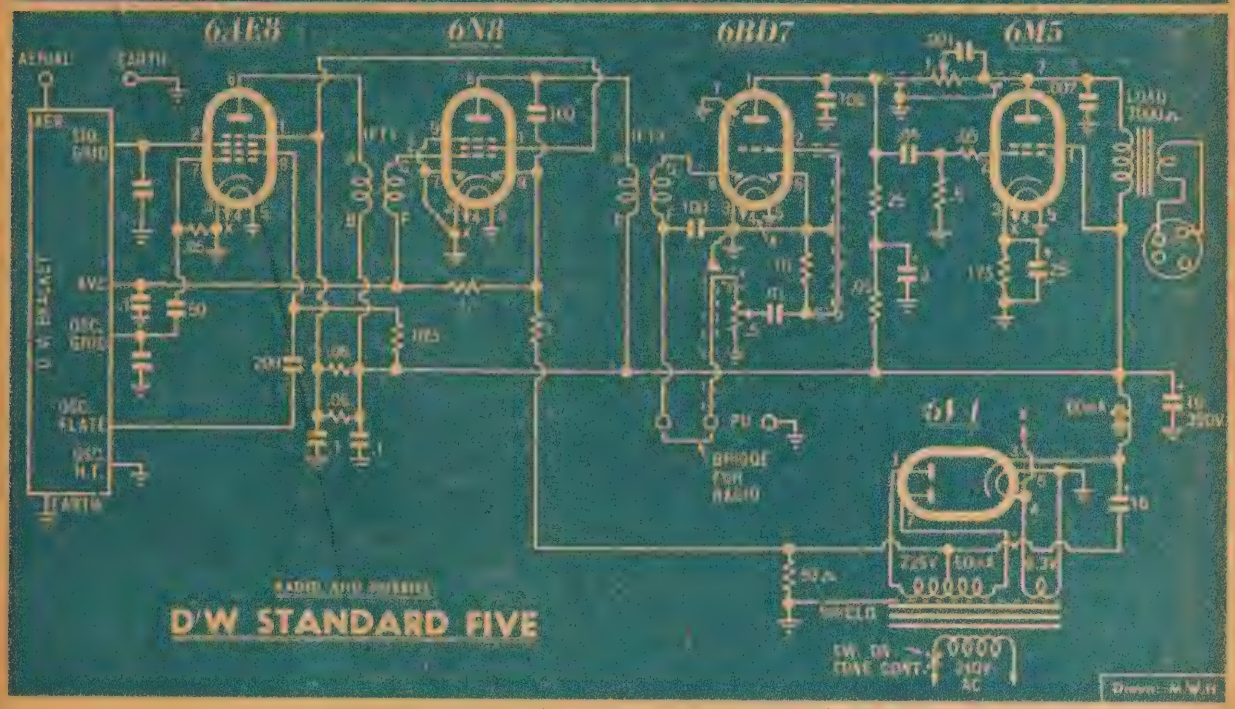
SW SET SCORES

This is where a good short-wave set can be of immense benefit. When summer static and local storms make conditions impossible on the broadcast band it will usually be found that short-wave reception is still good. For this reason the authorities have provided several powerful short-wave channels to carry a selection from the regular ABC programs.

Another worthwhile program source is Radio Australia which provides programs mainly for overseas reception but often draws on the most popular local programs from both ABC and commercial sources.

In addition there are two "ham" bands covered by the short-wave section which will provide interesting listening for those considering

CIRCUIT DIAGRAM OF THE NEW DUAL-WAVE RECEIVER



The circuit is very similar to the AC Standard Five recently described. Changes involve the pickup terminals, the filament wiring, and the provision of a shunt feed connection to the oscillator coil. This latter arrangement is to allow all types of brackets to be used.

studying for their "ticket", plus the numerous overseas services which often provide excellent entertainment.

Thus it is easy to appreciate that the short-wave section of the set can easily be made to pull its weight.

With these points in mind we considered what could be done to produce a dual-wave set along the lines of the recent AC Standard Five (April, 1954), that is, a set which would be simple enough for anyone to build who could handle a soldering iron and a pair of pliers.

Contrary to what you might expect it is no harder to build a dual-wave set than a broadcast version. In fact, it is often simpler, because the relatively complicated switching arrangement required to select the various coils, plus the coils themselves, are all purchased ready wired as a compelte unit or "bracket". It only remains to connect half a dozen leads to the bracket and the front end is complete.

REMAINDER STANDARD

The remainder of the set is essentially the same as a broadcast set and should cause no qualms to anyone who can follow a few simple diagrams.

We decided to base the circuit and valve line-up on that which proved so effective in the AC Standard Five and we hoped that this would also mean that we could use the same chassis. However, a few trial assemblies with the various brackets currently available showed that the original layout was quite unsuitable. Some other previous chassis designs were also investigated but, for one reason or another, they proved unsuitable. As a result, there was nothing for it but a new chassis design.

Several minor modifications were found necessary in the circuit, though there are none which will prejudice the performance of the set in any way. The first point was the gram switch which could not conveniently be accommodated on the front of the chassis with the wave change switch. It could be fitted to the rear of the chassis or it can be replaced by a simple terminal arrangement with a link which is removed for pickup operation.

We have shown the latter arrangement, partly because it is a simpler scheme (though perhaps not quite so convenient) and partly because it is an interesting alternative. If you prefer the switch arrangement there is nothing to prevent you drilling an extra hole in the back of the chassis and fitting a simple two position switch as was used in the AC Standard Five.

Elimination of the switch also means that we have no way of "killing" the front end of the set when using a pickup and it is possible for low levels of radio program to leak through if the set is tuned to a powerful program. Easiest way out of this is simply to detune the set.

We also decided to simplify the filament wiring a little by running only one filament lead and using the earthing system for the return side. This is a perfectly satisfactory

PARTS LIST

1 Chassis 12½in x 6¾in x 2¾in.
1 Power transformer 225V a side at 50 mA, 6.3V at 2A.
1 60 mA filter choke.
1 2 gang tuning capacitor.
1 Dial with glass to suit gang and coil bracket (USL 32).
1 Dual-wave bracket suit 6AE8 valve.
2 455 Kc IF tranformers, 1st and 2nd, preferably high gain.
1 Permag. speaker, size as required.
1 7000 ohm speaker transformer.
5 9-pin miniature valve sockets.
1 miniature speaker socket and plug.

VALVES

1 6AE8, 1 6AN7, 1 6BD7, 1 6M5, and 1 6V4.

CAPACITORS

1 25 mfd 40PV electrolytic, 1 16 mfd 525PV electrolytic, 1 16 mfd 350PV electrolytic, 1 8 mfd 350PV electrolytic, 2 .1 mfd 400V, 1 .1 200V, 1 .05 mfd, 1 .01 600V, 1 .002 mfd, 1 .001 mfd, 1200pf mica, 3 100pf mica, 150pf mica.

RESISTORS

1 10 meg. ½W, 2 1 meg. ½W, 1 1 meg pot with switch, 1 .5 meg. ½W, 1 .5meg. pot, 1 .25 meg. ½W 2 .06 meg. 1W, 3 .05 meg. ½W, 1 .025 meg. 1W, 1 175 ohm 1W, 1 50 ohm 1W.

SUNDRIES

4 Knobs, power flex and plug, 5 terminals, 2 6.3V 150 mA dial lamps, 1 3-terminal tag strip, 2 5-terminal tag strips, 1 8-terminal tag strip, tinned copper wire, hookup wire, shielded wire, spaghetti tubing, solder lugs, solder, nuts and bolts, washers rubber grommets, etc.

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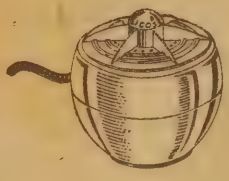

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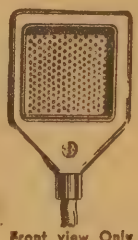

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TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.3-2	General Purpose	1¾in dia. x ⅜in thick	20db Peak at 2500 C.P.S.	Mona	£1 19 3
MIC.3-5	„ „	„ „ „ „ „	12db „ „ „ „	Mervyn	1 19 3
MIC.3-6	„ „	„ „ „ „ „	5db „ „ „ „	Myrtle	1 19 3

MIC. 6 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.6-4	General Purpose	2 1-32in dia. x 19-32 thick	20db Peak at 2250 C.P.S.	Margie	£1 19 3
MIC.6-6	„ „	„ „ „ „ „	5db „ „ „ „	Maudie	1 19 3
MIC.6-11	„ „	„ „ „ „ „	12db „ „ „ „	Mandy	1 19 3

MIC. 14 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.14-5	General Purpose	1 7-16in dia. x 11-32in thick	20db Peak at 3500 C.P.S.	Maxie	£1 19 6
MIC.14-11	„ „	„ „ „ „ „	12db „ „ „ „	Mitchell	1 19 6
MIC.14-12	„ „	„ „ „ „ „	5db „ „ „ „	Malcolm	1 19 6
MIC.15	Hearing Aid	0.9in dia. x 0.155in thick	30db „ „ 3000 „	Marlene	1 19 6
MIC.17	„ „	15-16 in sq. x 7-32in thick	30db „ „ 3500 „	Maggie	1 19 6
MIC.18	General Purpose	1 7-16 in dia. x 9-32in thick	20db „ „ „ „	Maisie	1 19 6

MIC. 23 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.23	General Purpose	1 3-16 sq. x ¼in thick	20db Peak at 3000 C.P.S.	Maureen	£1 19 3
MIC.23-3	„ „	„ „ „ „ „	5db „ „ „ „	Margaret	1 19 3
MIC.23-4	„ „	„ „ „ „ „	12db „ „ „ „	Milton	1 19 3
MIC.32	High Quality	1 13-16 dia. x 9-16in thick		Martin	2 15 6

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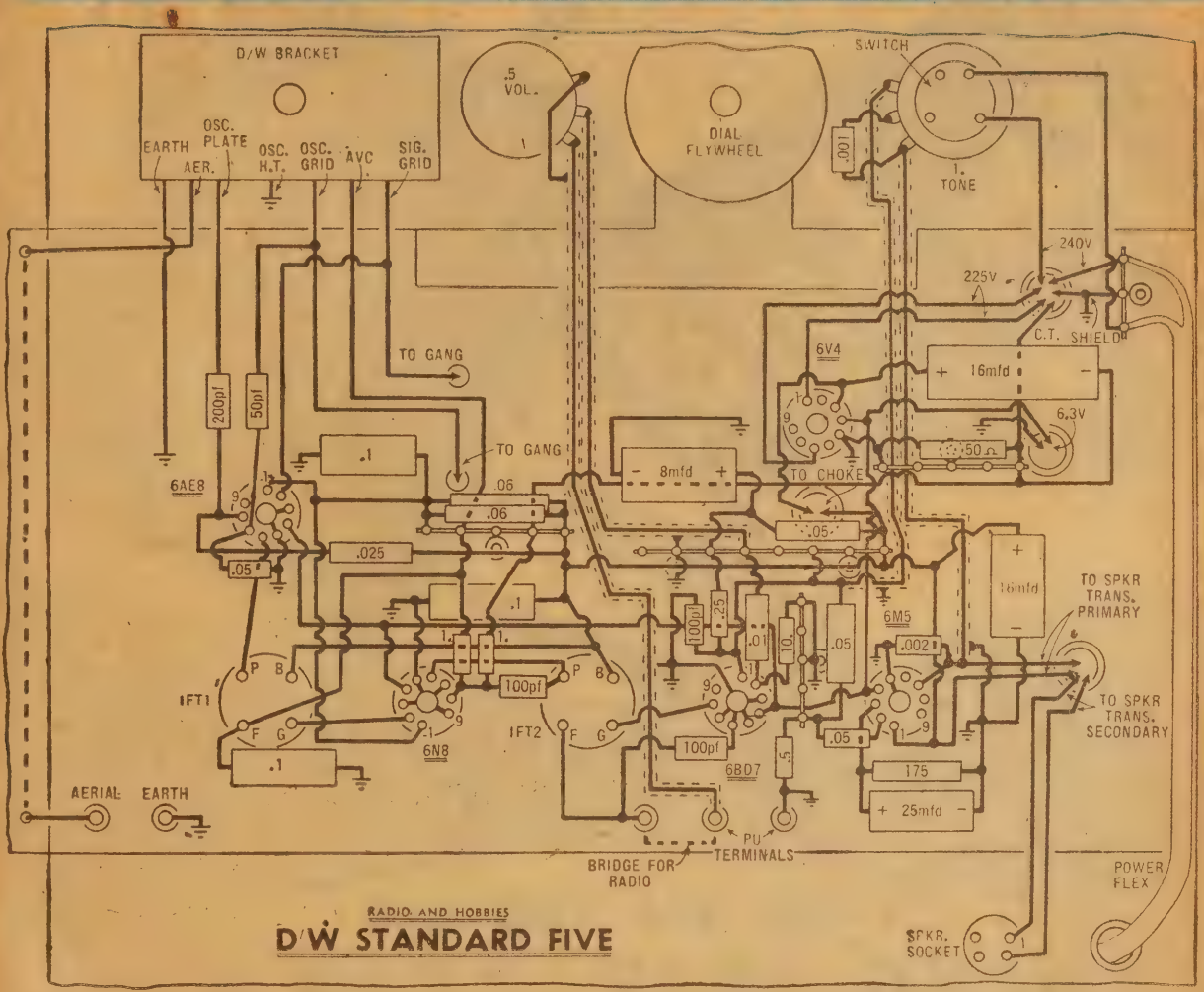
UNDERCHASSIS DIAGRAM WILL HELP BEGINNERS



This underchassis diagram will be found extremely valuable to both the beginner and experienced builder. In addition to the wiring it shows the placement of all parts and their corect orientation. This latter point is most important if short leads are to be retained.

arrangement where the audio system does not involve any high gain or bass boost circuits which might aggravate hum.

Another alteration is concerned with the dual-wave bracket. At least one of the current types is designed for a shunt feed oscillator circuit and is so wired that it is not possible to use it with any other arrangement. Since the alternative types can be wired in either manner we decided to adopt the shunt-fed method to make the circuit completely universal.

SHUNT FEED CIRCUIT

In the shunt feed arrangement the oscillator plate is connected to HT through its own dropping resistor and is coupled to the plate winding through a small value of capacitance. The other side of the winding goes to chassis. This means that brackets intended for the more conventional connection should have the "Osc. HT" terminal connected to chassis.

When you come to select a dual-wave bracket you will find that there is quite a variety to choose from. Some are quite elaborate devices and others are simplified to just about the irreducible minimum. You can please yourself which you buy and we can only say that, in terms of performance, there is little to choose between them.

One of the simplest uses iron cores only in the broadcast coils, meaning that one has to take the short-wave coils more or less "on trust". The fact that this particular bracket put up just as good a performance as the more elaborate versions suggests that the makers had done their job well before issuing it.

At present most brackets are designed to cover a similar band, from about six to 18Mc (16 to 50 metres). and this has most to offer in terms of suitable stations. It is as well to make sure that this range is covered rather than the older 13 to 45 metre band. Also make sure you get a dial glass which is calibrated to suit.

Finally, make sure that the bracket is intended for use with the 6AE8 valve. Most makers supply a model which is suitable for both the 6AE8 and the 6AN7, these valves having similar characteristics.

The only other components calling for special comment are the IF transformers. These are normally available in various types, such as medium gain, high gain &c. In the case of a broadcast set the medium gain types are usually quite satisfactory and are a few shillings cheaper. For best short-wave results, however, we recommend a pair of high gain types, the extra few shillings being well worth while.

The remaining components are quite straightforward and any reliable brands should be quite satisfactory.

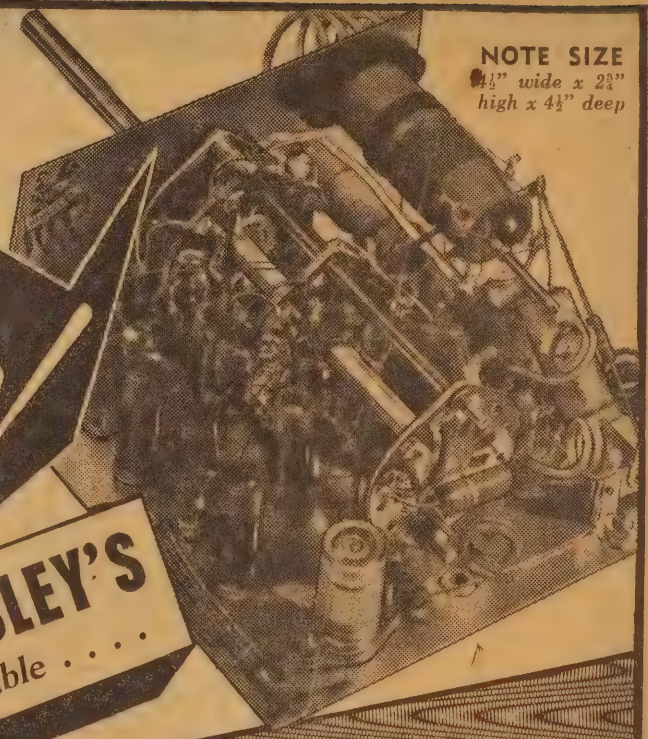
Which brings us to the point where you have probably purchased a kit of parts, spread them on the kitchen table, and commenced to wonder whether it will ever be a radio set. If so, there is no need to panic. By taking things in easy stages you will find that apparently major worries practically cease to exist when you come to them.

ASSEMBLY

The first job is to get the major parts assembled on to the chassis. This will make things look much more orderly and you will immediately feel that you're "getting somewhere". The wiring diagram will provide most of the guidance for

It's here!

NOTE SIZE
4½" wide x 2¾" high x 4½" deep



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this job, since it shows the correct orientations of the valve sockets and IF transformers, and the location of the tag strips, &c. Note also the order in which the leads from the power transformer are brought through the chassis.

As the various components are mounted, a solder lug should be slipped under the mounting bolts to provide earthing points. It is as well to be fairly liberal in this regard, since it may be awkward to fit a lug after the wiring is partly completed.

One of the larger tag strips is mounted by means of a countersunk screw which is under the filter choke, so see that this latter is not fitted until the tag strip is in place. The choke itself is best fitted with a pair of short lengths of hookup wire before it is mounted, since these will be harder to solder in place later.

When mounting the IF transformers remember that they must go in the correct order, the first going between the 6AE8 and 6N8 sockets. The number of the IF is normally given on the carton. In many cases the first IF will have a lead coming from the top of the can. This is not needed with modern valves and the transformer should be slipped out of the can and the lead clipped off close to its terminal.

Also be careful not to screw the mounting nuts too hard. The lugs which are attached to the can are easily pulled out and this can render the can virtually useless.

DIAL DETAILS

Fitting the gang is quite straightforward, but the dial may call for some comment. As supplied, the drum will be held in place with a single screw in the central bush. This is intended only to hold the works together until the dial is mounted, after which it must be removed in order to allow the drum to mount on the gang shaft.

Many constructors prefer to leave the dial mounting until the set is almost complete, since this reduces the risk of breaking the glass while handling the chassis. However it is a good idea to fit the dial temporarily, just to make sure that all the mounting holes line up and to enable any to be filed if necessary. This is very much easier, and safer, before other components are fitted

At least one type of bracket is attached to the front panel by means of two screws and this will need to be fitted before the dial, since one of the screws is behind the dial plate. For the same reason a countersunk screw will be needed in place of the 5-32in round head type normally supplied. A 5-32in x 3-8in is the most suitable size.

The speaker transformer will need to be raised slightly above the chassis to provide clearance for the leads, and this may be done either by means of washers or a couple of extra nuts run on to the mounting screws to serve as spacers.

With the assembly completed the next step is the actual wiring. The first stage is to wire in a fairly extensive earthing network, since it is unwise to rely on doubtful connections to the chassis for these return paths.

The main run will be from socket to socket, commencing at the converter on the lug nearest the front of the chassis and running on the inside of the sockets to the rectifier lug nearest the end of the chassis. Other short connections will need to be added as the wiring proceeds, but this main run should be done first.

Tinned copper wire of about 18 or 20 gauge should be used for this job and should be straightened first by stretching. This wire can also be used for some of the shorter connections in the main wiring, as well as the earthing around each socket.

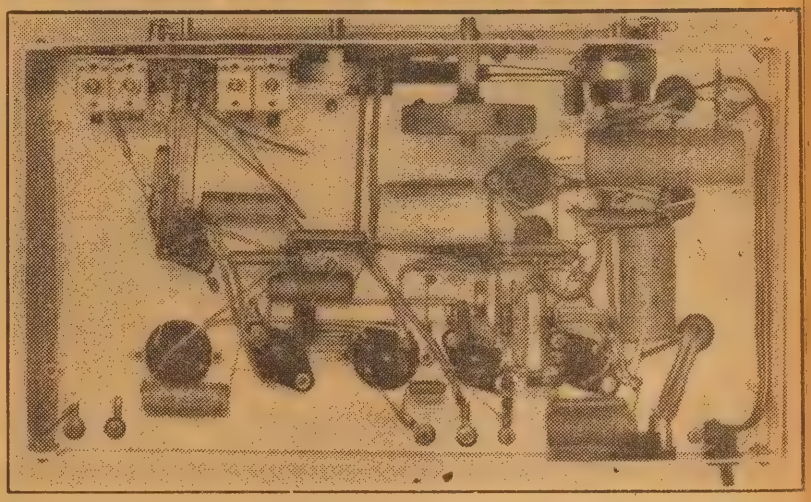
This latter job is best done at this stage and consists of earthing all those socket pins which are so marked in the circuit, as well as the central socket shield. This is most important in order to avoid unwanted coupling between grid and plate pins.

The 6AE8 socket should have the following earth connection: Shield and pins 3 and 5. The 6N8: Shield, pins 3, 5, 7, and 9. The 6BD7: Shield, pins 3, 5, 6, and 7. 6M5: Shield and pin 5. 6V4: Pin 5.

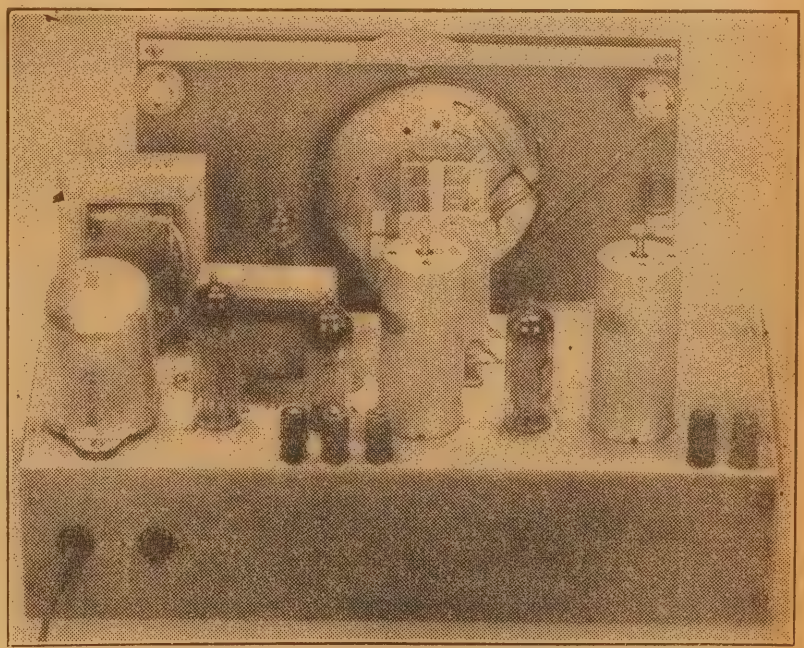
Most brackets are supplied with a length of tinned copper braid connected to the frame and intended to be conected into the earth network of the set. This should be done at the nearest point, usually at the converter socket.

Next the leads from the power

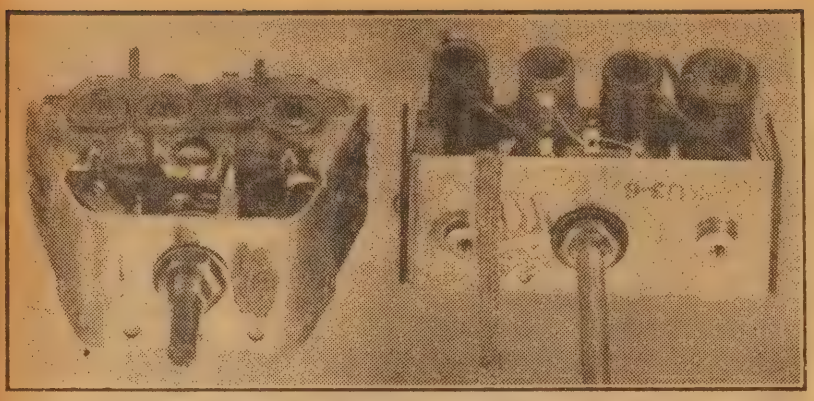
UNDERNEATH VIEW OF THE SET



The underchassis picture should be studied in conjunction with the wiring diagram. On the left is seen the coil bracket, and there is plenty of room for other types. Alongside it is the volume control, then the dial flywheel, and the tone control.



A rear view showing the placement of the major components. Left front is the power transformer and near the rear of the chassis the speaker transformer. Valves from left to right are: 6M5, 6BD7, and 6N8, with the 6V4 partly obscured by the filter choke. The 6AE8 is behind the 1st IF transformer.



Two alternative types of decks which should be readily available and which were tried in the original chassis. Both gave excellent results, as did the one shown in the chassis photograph. Cores and trimmers for the bracket on the underside.

transformer, filter choke, and speaker transformer may be cut to length and connected to their various terminals and the wiring proper can be commenced.

Most of this can be done with plastic hook-up wire, such as 10/.010. However, many of the shorter runs are easier to make with tinned copper wire, either bare, or, if there is a danger of another wire touching it, insulated with a length of spaghetti tubing.

From this point on the wiring can be followed from either the circuit diagram, or, if you're a raw beginner, from the wiring diagram. In any case the wiring diagram will be useful to indicate the placement of parts, particularly around the 6BD7 socket, where there are quite a number to be accommodated.

In the front end of the set, particularly around the bracket, it is most important to keep all leads as short and direct as possible. Don't be tempted to bend them into fancy shapes in an effort to make them look pretty or the result may easily be trouble in the form of instability.

Note particularly that the aerial lead is taken along the outside of the chassis to reach its terminal at the rear. This is essential to avoid any coupling between it and other stages of the set.

Another wiring point to watch is around the AVC diode pin of the 6N8 (pin 8). The two 1-meg. resistors which connect to this pin should be mounted as close as possible to the pin, the pigtails being made no longer than absolutely necessary at this end.

Other than these few points there is nothing critical about the wiring and a few hours' careful work should see it completed. There is no reason either why the reader should not make as neat a job as the original.

With the wiring completed and carefully checked it is time for a trial run. Plug in the speaker and connect to the mains, keeping one eye on the rectifier and a hand on the switch, ready to switch off in the event of any fireworks. If all appears well the set should warm up in about half a minute and show some signs of life when it is tuned over the broadcast band.

However, it is quite likely that the performance of the set may be quite poor at this stage, due to the need for the various tuned circuits to be brought into alignment. These include the two IF transformers, with two adjustments each, the broadcast aerial and oscillator trimmers, the broadcast aerial and oscillator slugs, the short-wave aerial and oscillator trimmers, and the short-wave aerial and oscillator slugs, if any.

CORRECT ORDER

This may seem a formidable array, but it is not difficult if they are tackled in the correct order. The main thing is to get the IF transformers peaked and, ideally, on the correct frequency. Although a reasonable job can be done by ear, it is really best done with an

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oscillator or signal generator. Once this is done, the remainder of the adjustments can be performed, by ear, if necessary, with much more chance of success.

For this reason it is worth while making a special effort to beg, borrow or steal an oscillator, which will do at least this much. One of the simple devices designed to deliver a 455 Kc signal will do. A multimeter with output facilities will also help and this should be connected between the 6M5 plate and chassis.

If it is not possible to align the IF channel with an oscillator, it is best to leave the job until after the broadcast trimmers and slugs have been adjusted.

To do this it is first necessary to set the pointer correctly with relation to the gang. Some dials have a "set pointer" line at the low frequency end, but, if not, you will have to work by trial and error. Try a position about half-way between the 550 Kc mark and the line marking the end of the dial. If it is not correct the tracking with the dial calibrations will be poor in the centre of the band and a slightly different setting will have to be tried.

SLUGS AND TRIMMERS

Next tune the set to a station at the low frequency end, say 2FC, and note whether the pointer tallies with the dial calibration. If not—and it is likely that it won't—the slug in the broadcast oscillator coil should be adjusted until it does. Then the aerial coil slug should be adjusted until the signal reaches maximum strength.

Now tune in a station at the high frequency end of the band, say 2SM, and repeat the procedure, using the oscillator trimer to adjust the calibration and the aerial trimmer to provide the maximum gain.

Adjustments involving sensitivity, as distinct from those of calibration, are usually more accurate on a weak station, and this may be tried after the first rough adjustment has been made. Try to select a station giving a steady signal even though it is weak and best results are usually obtained in the daytime. Remember that the trimmer is adjusted at the high frequency end and the slug at the low frequency end.

It is at this point that the IF transformers should be peaked if they have not been previously adjusted with an oscillator. Once again a weak steady signal is best, and the slugs should be carefully adjusted until the signal is at maximum strength. This will ensure that all the transformers are at least tuned to the same frequency, even if it is not the ideal frequency of 455 Kc.

The short-wave section is handled in a similar manner, with some additional precautions. The most important is to avoid making adjustments on the image rather than the true signal. Any strong signal is likely to cause an image on a relatively simple short-wave set of this type, and it will be found at twice the IF from the real image. When two signals are found in this manner the correct one will be that on the higher frequency.

SHORT-WAVE ADJUSTMENT

If the bracket has slugs in the short-wave coils these should be adjusted at the low frequency end of the band. In most cases there is not much point in adjusting the oscillator slug, since the calibration markings on most dials are only of a general nature. It only remains, therefore, to adjust the aerial slug for maximum sensitivity.

Similar remarks apply to the trimmers at the high frequency end. If it is not possible to find a suitable station a fairly accurate job can be done using the general noise level. This will at least bring the sensitivity to the point where suitable stations are more likely to be heard.

With all these adjustments correctly carried out the set should be quite lively and capable of a really excellent performance on both the broadcast and short-wave bands. The original version was most impressive and there is no reason why yours should not do just as well.

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VLW			9.61 — 11.84 Mc
VLX			4.8975 — 9.61 Mc
PORT MORESBY			
VLT			6.13 Mc

A DE-LUXE CRYSTAL SET

(Continued from Page 31)

20 turns from the earthed end of the other one.

We suggest that you start with the tappings in these positions, then listen for a station near the high frequency end of the band. Rock the dial slightly and adjust the trimmers one at a time, noting whether a particular adjustment makes the signal stronger or weaker.

Check on the general performance of the set, then move the tapping points one at a time and try again, remembering that the trimmers should be readjusted after the tapping has been shifted.

When you have a fair idea of the set's performance, try a small amount of top coupling, as mentioned earlier in the article. This may have to be accompanied by a general downward shift of the tappings and a readjustment of the trimmers for best results.

In all, you'll probably spend the best part of an evening trying this and trying that but that's half the fun. As we said earlier, we got quite a kick out of coaxing the last bit of performance out of the little set.

And when we finally turned it over to "Junior" and saw him check everystation, the look on his face simply registered "My dad can do just about anything".

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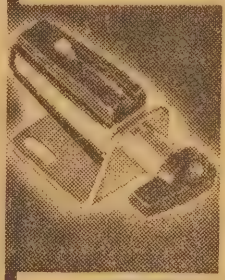

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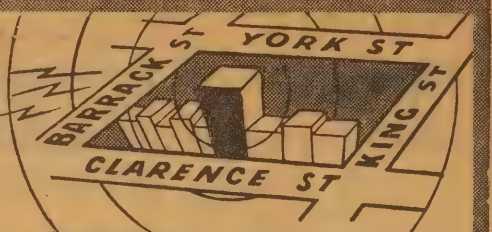

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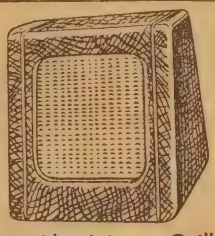

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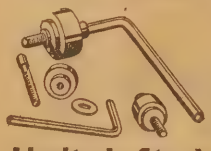

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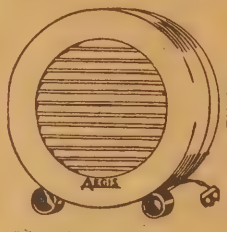

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GETTING AN AMATEUR LICENCE

In case you haven't heard, it is no longer necessary to pass a Morse code exam in order to become a radio "ham". If the code has always worried you, you can take a new interest in the ham ticket because, in the next few months, we are going to coach you to the point where you can get that ticket.

THE regulations now permit an amateur station licence to be granted without an examination in Morse Code, assuming that the candidate can pass the theory and regulation papers satisfactorily.

Licences granted on this basis permit operation on amateur bands from 144 Mc upward in terms of frequency. If the licensee wishes to extend his activities to the lower frequencies at any time in the future, he can do so simply by passing the Morse exam.

If you are really interested in sitting for this exam, the first thing to do is obtain a pamphlet from the PMG's Department, describing the conditions under which amateur licences are granted. This provides all the details of the examination, how to make application to sit for it, when and where it will be held, and a brief syllabus of study requirements.

PREVIOUS PAPERS

From the same source you may obtain copies of previous examination papers at 6d each, and a Handbook for Operators of Amateur Wireless Stations (in other words, the Regulations) priced at 2/-. Since you will also require an application form (for the examination) you might as well obtain this at the same time.

Such requests should be addressed to the Superintendent, Wireless Branch, either in the capital city of your State or at one of a number of country centres. A complete list of these addresses is given in a panel elsewhere.

Examinations are held on the second Tuesday in January, April, July, and October of each year in the capital cities and country centres as mentioned above. In addition, any candidate living more than 50 miles from one of these centres may apply to have the exam. conducted at the nearest official post office where suitable facilities exist.

Applications to sit for the examination must reach their destination not later than the 15th of the month preceding the exam. You will have to supply a copy of your birth certificate (an Extract Copy will suffice), and a few other personal details. The examination fee is £1. You will be advised as to the exact time and place of the examination.

TECHNICAL STANDARD

What is the technical standard? A specimen examination paper is printed herewith to give you some idea. Some of it you could answer right now, other parts will leave you completely cold.

Remember that you are only required to answer seven of the nine questions and that a figure of 70 pc is required for a pass. Assuming equal marks for each question it means that you would have to answer at least five questions—well enough to be given full marks—in order to just scrape a pass. This is hardly good enough, but if you feel confident about answering at least six questions completely, and one in part, you should make a very good showing indeed.

We must make it quite clear that at this juncture we do not propose to provide a complete radio course, on the assumption that you know practically nothing. We feel there are many experienced home builders, who may need guidance only in the less familiar subjects to bring them to the required standard. The articles which will follow each month are intended to help them out of this unfamiliar ground, and not to school them in radio from A to Z.

We do not, therefore, intend to give the life story of resistors or capacitors on the assumption that you have never seen them before.

We are going to assume that you know many fundamentals, and that you can easily "swot up" on them if you have become rusty.

In fact, we are assuming that you are a typical reader of Radio and Hobbies, who is keen enough to have learned a fair amount of theory, built some receivers and amplifiers, according to your taste and pocket, and can find most of the ordinary faults in such equipment.

OHM'S LAW

Coming now to the subjects in greater detail, the first and most obvious is Ohm's Law, because every paper appears to carry at least one question based on it. And by knowing Ohm's law we don't mean a mere parrot fashion repetition of the ritual "R equals E over I". You must be able to work the formulaes backwards and forwards, and apply them to typical examples.

Since the questions will be framed in the form of practical problems you must be able to handle them in this manner. Such questions are likely to involve series and/or parallel networks, voltage dividers current and voltage division in simple networks, power dissipation calculation either from voltage and current, voltage and resistance, or current and resistance.

Problems concerning bias resistors screen dropping resistors and such like are almost certain, while problems on meter shunts and multipliers are quite common.

You must also appreciate the traps likely to be created by the use of milliamps and megohms, and be able to convert from these units without dropping a nought or two and producing a ridiculous answer.

Be familiar with Ohm's Law. It needs only elementary arithmetic, common sense, and practice. You meet variations of it everywhere you turn.

A knowledge of receivers is also necessary and the normal routine of experimenting will serve as an excellent basis. However, you must know those characteristics and requirements peculiar to amateur communication.

In addition to the ordinary superhet, you should know the principle of the double change superheterodyne and be able to explain its characteristics and advantages. It is unlikely that a complete circuit of a receiver will be asked for but block diagrams are often required. Be wise, and learn a typical circuit by heart.

VHF EQUIPMENT

With the increased use of the higher frequencies it is likely that questions may be asked about aspects peculiar to VHF receivers. Thus grounded-grid amplifiers, cascode stages, and the like can quite easily provide a basis for some questions. These are essentially simple, but as you will be using VHF, make them your specialty.

You will also need to know the basis of operation and reason for use of such things as crystal filters, beat frequency oscillators (BFO), noise limiters, &c. Take these easy, one at a time, and don't be scared because the terms may be unfamiliar. You'll find they are based upon things you already know.

We will assume you are familiar with the operation of the ordinary receiving valve and can distinguish between the operation of a diode, triode, tetrode, pentode, &c., and the purpose of the various elements. You should know the difference between a directly and indirectly heated cathode, the meaning of "Class A", "Class AB1", "Class AB2", and "Class B" well enough to write a simple explanation that will convince an examiner.

VALVES

It is hard to draw a sharp line of demarkation on the subject of valves because a knowledge of their operation pre-supposes a knowledge of the associated circuitry. For this reason one may be asked questions about the operation of complete stages, such as a frequency converter stage or power supply, with the emphasis on the part which the valve plays. Questions like this depend largly upon your ability to use your individual knowledge and to tie various items together reasonably and logically.

Our average reader will probably be less familiar with transmitters

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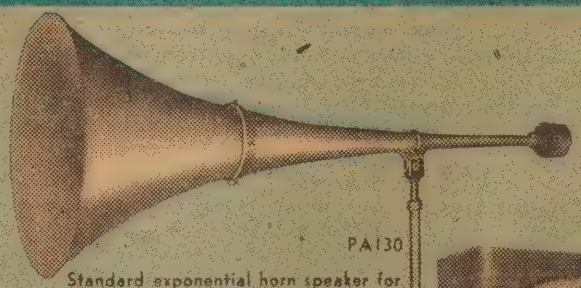
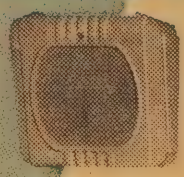


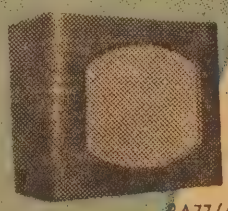
PA130

Standard exponential horn speaker for public address where distance projection of speech and incidental music is required.



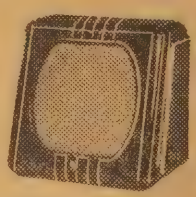
PA150/I

Attractive moulded ivory cabinet with 7" cone speaker and 600 ohm line transformer. Suitable for wall or desk mounting



PA77/AU48

Polished timber cabinet for wall or table mounting with 12" cone speaker and 600 ohm line transformer.

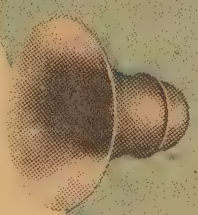


PA150/W

Moulded walnut speaker similar to above. These models are also available with 600 ohm stepped faders.

RESLO DRIVE UNITS: SU10 & SU12

Exclusive features are the self-locating diaphragm and the concentrically interlocked magnet which together produce an undisplaceable mechanical assembly, proof against de-centering.



PA108 & PA109

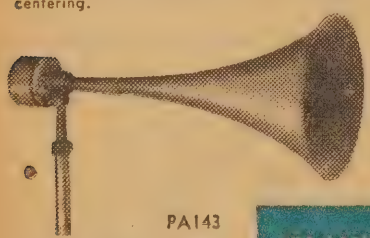
These flare baffles are for use with 7in and 12in permanent magnet cone speaker units and provide high conversion efficiency.

PA118

Pendant type, ceiling suspension, 360° diffusion speaker suitable for distribution of voice and music.

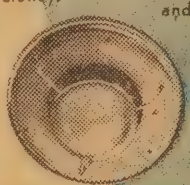
PA73

Ivory timber cabinet with 7in speaker for applications where a bi-directional characteristic is desired.



PA143

Short exponential horn speaker for distance projection of speech only.



PA177

Flush, ceiling mount 360° diffusion reproducer with 7" cone speaker. Can be colour matched to suit any background.

PA178

Surface mount reproducer similar to PA177, for use where flush fitting is not practicable.

PLANNED FOR OPTIMUM FAITHFULNESS OF SOUND REPRODUCTION, IN KEEPING WITH PHYSICAL AND COST REQUIREMENTS, IN STYLES AND FINISHES TO SUIT ANY BACKGROUND OR CIRCUMSTANCE OF USE.

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than with anything else. Let's see some of the things he will need to know.

1. The generation of RF, various types of oscillators, crystals, their characteristics and the circuits usually employed with them. This leads logically to frequency multiplication, and the power amplifier stage, modulated or otherwise.

2. The need for neutralisation in amplifiers, the various methods employed, and the adjustment procedures to be adopted for such stages. Some valves don't need neutralising — find out which types, and why.

3. The operation of the class C amplifier, the importance of correct grid bias, tuning methods of the output or "tank" circuit, and how to couple the aerial.

4. Tuning procedure, the various metering circuits in a transmitter, the significance of the meter readings, and what readings to expect when adjusting a transmitter.

MODULATION

5. The subject of modulation will be dealt with on the assumption that the reader is reasonably familiar with microphones, pre-amplifiers, phase changers, power output stages, &c., as normally met with in audio practice, and can draw the circuit of a typical audio amplifier. After all, the normal "plate" modulator is only a large amplifier, but we will have to spend some time explaining how it is connected and matched to the transmitter.

6. We will discuss aerials, transmission lines, aerial tuning units, propagation patterns, directional aerials, methods of coupling to the transmitter, &c., which should just about round off your studies.

The foregoing is a brief resume of some subjects to be treated. Many paragraphs contain enough material for a complete article, so that the entire course will obviously occupy several months. At the same time you will find other articles not actually in the "course", which will help your studies, so that a continuous stream of useful material will be available. The main articles will dive into the various sections of the examination papers, and attempt to outline what the examiner wants to know about each.

At the same time every prospective candidate will have to do a certain amount of study to bring him up to the standard we are assuming. For this purpose a small selection of good textbooks is essential both for purposes of revision and to tie together the loose ends of previous study and experience.

SOME GOOD BOOKS

After making a survey of the books available we listed those we consider most suitable for study. These are not the only books, but we have selected those which do not go beyond the relevant subject matter and which are reasonably priced.

Your best method is to visit the various booksellers and select those books, which fill the gaps in your knowledge at a price you can afford.

Regarded as a "must" for every prospective amateur is the Radio Amateur's Handbook, published by the American Radio Relay League. As a practical handbook this is an excellent publication and covers just about every phase of amateur equipment likely to be encountered in practice. It also covers the fundamentals, so that it is likely to be valuable after the exam as well as before.

It is readily available at the present time and is priced at approximately 44/-.

Remember, when you get this book that you don't need to memorise all the wealth of data between its covers. You may not even read it all, but you should examine it thoroughly, studying the relevant theory portions and using the "how to build it" sections as background.

Of a somewhat different type are two excellent books published by the RCA Manufacturing Co. of the USA. These are the RCA Receiving Tube Manual and the RCA Air-Cooled Transmitting Tube Manual. Both provide technical data and operating conditions for a wide range of valves in these two classifications, and are worth their purchase price on this score alone.

In addition both have chapters devoted to the operation of valves in general, commencing with the simple diode and progressing through to the pentode and beam tube, plus sections devoted to explanations of the circuits in which the valves are to function.

Not the least attractive feature of these books is their low cost, being in the order of 6/- to 8/- each.

Another book covering the operation of valves and associated circuits is a Wireless World publication called "Introduction To Valves." This is one of the few valve books which does not pre-suppose that the reader has a university degree, and is intended mainly for the novice or student in the early stages of his training. It is readily available and priced at approximately 15/-.

Every serious student and experimenter should have on his bookshelf all the valve data booklets and pamphlets available from local manufacturers and distributors. Some of these are free, most cost a few shillings, but they all contain valuable data which no practical worker can afford to overlook.

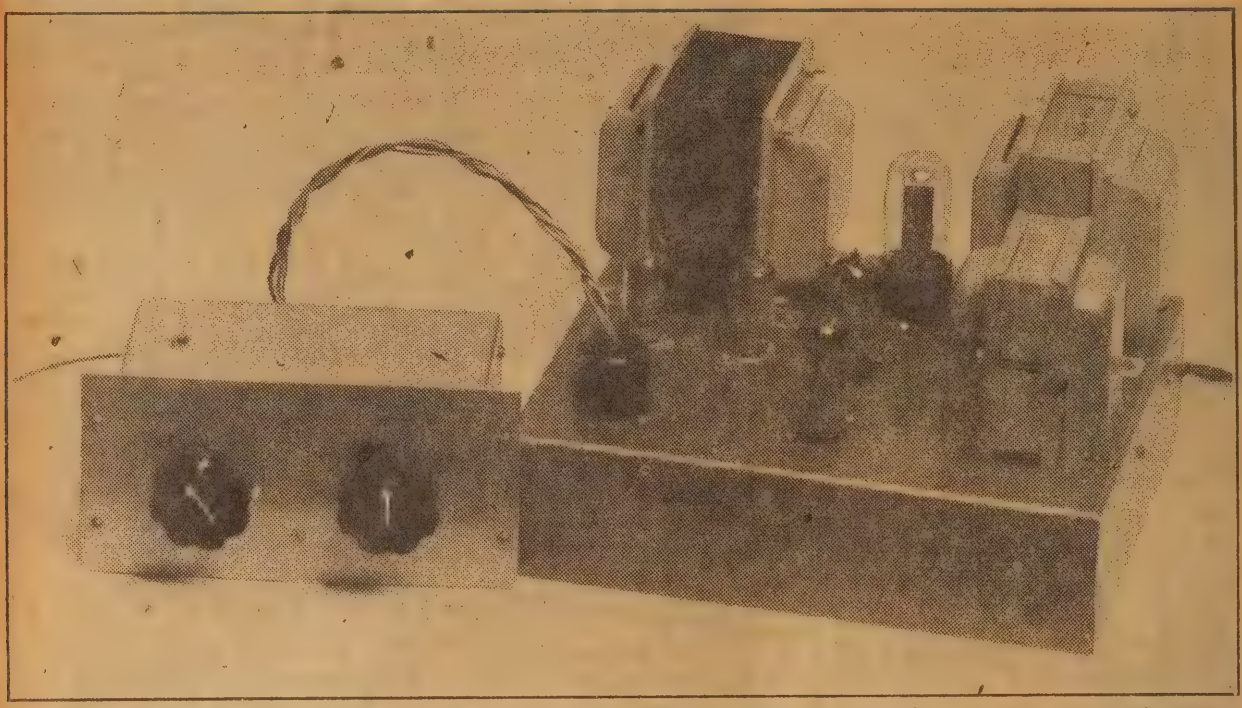
Still another type of book, but one which contains some excellent material, is the British Admiralty Handbook of Wireless Telegraphy. Much of it may be disregarded by

(Continued on Page 102.)

AOCP EXAMINATION PAPER, APRIL, 1954

TIME 2½ HR. ATTEMPT SEVEN QUESTIONS

1. (a) Discuss the theory of single sideband reduced carrier transmission and reception.
   (b) Indicate the advantages of this type of transmission as compared with that of the normal double sideband type.
2. (a) Discuss the statement "The resistance of a conductor depends on its dimensions, its material and its temperature".
   (b) Explain briefly why the resistance of a conductor may vary with the frequency of the current flowing through it.
   (c) The direct current resistance of a piece of circular wire "A" is 100 ohms. A wire "B" is made of the same metal as "A" but is of twice the length and twice the diameter of "A". What is the resistance of "B"?
3. (a) Explain, with the relative theory, how Lecher lines may be used to measure the frequency of a transmitter operating in the 144 megacycle band.
   (b) What advantages do Lecher lines possess over heterodyne frequency meters for frequency measurement in this band?
4. (a) Draw a circuit diagram of the RF section of a telephony transmitter suitable for an amateur station. Points of connection to the modulator and supply voltages only need be shown but approximate values of the supply voltage should be included.
   (b) Indicate briefly why a push-pull output stage may be preferable to a single ended stage for use in a transmitter output stage.
   (c) Explain, step by step, how you would neutralise a single ended RF amplifier.
5. (a) With the aid of a circuit diagram explain the theory of a reactance tube modulator suitable for producing frequency modulated voltages.
   (b) Define (i) Modulation Index, (ii) Deviation Ratio of a frequency modulated signal.
6. An amplifier valve is rated at 10 milliamperes plate current with a supply voltage of 250 volts. Show how you would connect two 20,000 ohm resistors to allow the valve to operate at its rating from a 350 volt power supply. Show your calculations. What should be the minimum wattage rating of each resistor employed?
7. (a) Draw a block schematic design of a superheterodyne receiver capable of receiving keyed continuous waves and incorporating a crystal filter.
   (b) Explain fully, quoting specific frequencies, the function of each stage.
   (c) Discuss the theory involved when a change of note is desired in the output.
8. With the aid of a diagram, explain the theory of operation of a vibrator power supply suitable for deriving receiver HT voltages from a 6 volt accumulator. Include necessary filtering and explain the purpose of each filter component. Indicate approximate values of the filter components.
9. (a) Draw a circuit diagram from microphone input to modulation transformer of a modulator capable of providing 50 watts of audio power. The circuit is to include a phase inverter.
   (b) Discuss fully the theory of operation of each stage of the circuit drawn in answer to (a).



The "Standard No. 1" amplifier is built on the same chassis as the "Playmaster Seven" but uses less expensive power and output transformers. With it is the "Control Unit No. 5", which is equally adaptable to either the Playmaster or the new Standard series of amplifiers. It is a modernised version of the original Control Unit No. 1.

GOOD QUALITY AT LOWER COST

Can you make an amplifier reasonably priced and still get good quality? We think you can. This, the first Standard design, exploits the use of medium quality equipment, thus bringing good sound within the reach of almost any reader. While not quite as good as the famous Playmasters, you need not apologise to anyone for the results you will get from this simplified and more modest equipment. And you can build on the design without waste if later you wish to go really "high fidelity".

TYPICAL of folk we have in mind is the reader from Wagga Wagga, NSW, who has this to say:

"In common, I feel sure, with a large number of your readers, I am very fond of recorded music and like to hear it played on good quality equipment. However, after meeting our commitments, we are either not in a position or not prepared to invest such a large sum of money in a record playing unit."

He then goes on to suggest that we could trim down some of the extreme frequency specifications of the Playmaster series without seriously degrading the performance. In doing so, we might bring the total cost somewhere nearer to what he, for one, can afford.

Our correspondent is, we think, both right and wrong.

He is right in believing there are many readers who simply can't afford "the best that money can buy", no matter how much they might like it.

But he is wrong in presuming that the net cost ties itself so intimately to the design of the amplifier. In point of fact, it has more to do with the auxiliary gear, notably the pickup and speaker.

Let us analyse the position a little more closely:

The circuitry of the whole Playmaster series deliberately avoided complicated balancing and inversion circuits and over-ambitious feedback loops, because we reckoned that they could not be justified from the listener's point of view, and often lead to trouble in home building.

SIMPLE UNITS

We kept the control units simple, too, rejecting the obvious tendency to make them very clever from the front, but a hopeless mass of components from the rear, at least to the average eye.

By omitting the extra bass and treble knobs from the control unit, which though useful are not essential, cost can be considerably reduced while still retaining the essential feature of proper compensation for the various types of discs. We save two switches, numerous small components, reduce size and gain in simplicity. Expansion to a larger unit is always possible later without loss.

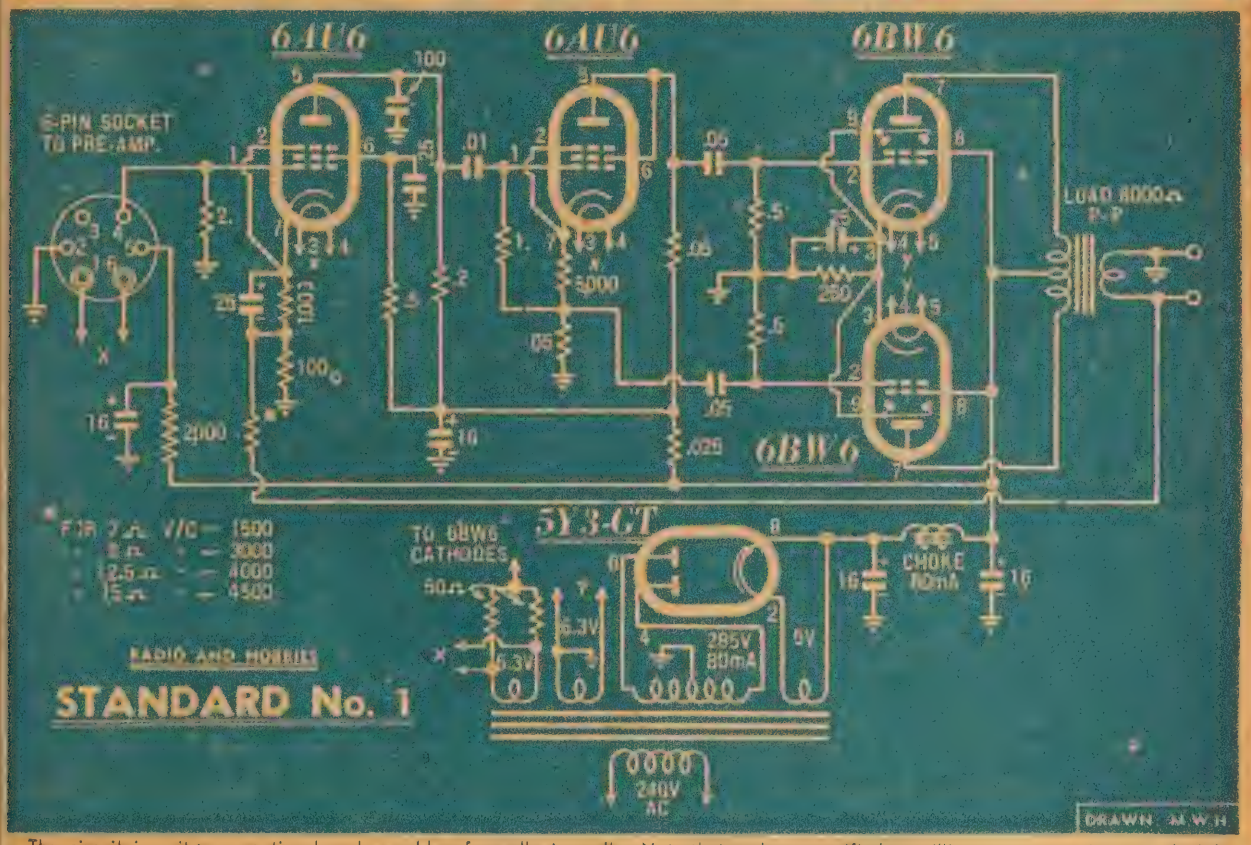
One can't hope to save much by trimming resistors and capacitors out of designs like last month's Playmaster Seven, or the simpler control units. Indeed, if any saving is to be made at all in the amplifier, it would have to be in the transformer equipment.

For instance, we specified a 125mA power transformer for the Playmaster Seven on the grounds that it would have an ample margin on current rating, even when supplying the main amplifier, a control unit, and a tuner of one kind or another.

We could have got away with a 100mA. unit quite safely, but, in general, readers who are prepared to pay twenty or thirty pounds for a speaker and more than that again for a pickup and motor, generally prefer to be liberal with component ratings.

If, however, there is no intention of running a tuner from the same supply, the transformer and filter choke can come down quite

CIRCUIT OF THE STANDARD AMPLIFIER NUMBER 1



The circuit is quite conventional and capable of excellent results. Note that we have specified 80-milliamp power equipment, which is adequate for the amplifier and control unit. If it is anticipated that a tuner will be used, it would be wise to buy a 100-milliamp power transformer at the cost of a few shillings.

safely to 80mA., with a considerable saving in first cost. As a compromise, a 100mA. rating should cover the needs of amplifier and tuner, with the manufacturer's own tolerance still in hand.

The other big item is the output transformer, which can run away with quite a few pounds. Once again, the urge to buy "nothing but the best" is very strong among those who have already invested in an expensive speaker. They like to think that the transformer is completely flat from here to there and never likely to be overloaded at any point in the range.

How far can one afford to retreat from this attitude by way of compromise?

The answer to this is often bound up in the speaker which it is proposed to use.

CUTTING COSTS

If the intention is to keep down the overall cost, there can be no question of paying out twenty or thirty pounds for one of the very high quality units—not immediately, anyway!

Logically, the choice narrows down to two or three locally-made or imported types ranging in the £6 to £10 class.

There's no need to despise these speakers because of their comparatively lower cost. They are used in the highly priced commercial Super De-Luxe radiograms, and one can make them sound very pleasant indeed by correct baffling and by feeding them with a balanced signal.

What is more, we wouldn't be at all surprised in the near future to see some tweeters come to light which will nicely supplement their high frequency response, if necessary.

The important point is that most of these speakers are not intended to handle more than about five or six watts of power, which is frequently ample for the ordinary home.

If one is, therefore, prepared to acknowledge this limited power capacity and also a limited performance below about 50 and above about 10,000 cps, then one can logically begin to scale down the requirements of the output transformer and with it, the cost, without spoiling good quality.

We can rely on voice coil feedback to straighten out the frequency response to better than manufac-

PARTS LIST

1 chassis 9½in x 8in x 2½in (Playmaster Amp. No. 7 chassis).
1 power transformer 285V a side 80mA, 6.3V 2A, 6.3V 2A, 5V 2A. (use 100MA type if tuner is anticipated).
1 80mA filter choke. (100 mA if tuner is used).
1 output transformer 8000 ohms P-P speaker voice coil impedance.
2 7-pin, and 2 9-pin miniature valve sockets, 1 6-pin plug and socket, 1 4-pin miniature plug and socket.

VALVES

2 6AU6, 2 6BW6, 1 5Y3-GT (5V4-G rectifier preferred where tuner is to be used).

CAPACITORS

2 25 mfd 40PV electros, 4 16 mfd 525PV electros, 1 .25 mfd 350VW, 3 .05 mfd 400VW, 1 100 pf.

RESISTORS

1 2 meg., 1 1 meg., 3 .5 meg., 1 .2 meg, 2 .05 meg., 1 .025 meg., 1 5000 ohm, 1 2000 ohm 3 watt (or 2 4000 ohm 1w in parallel), 1 1000 ohm, 1 260 ohm 3 watt, 1 100 ohm, 1 50 ohm 3 watt centre-tapped voice-coil feedback resistor. (All carbon resistors ½ watt).

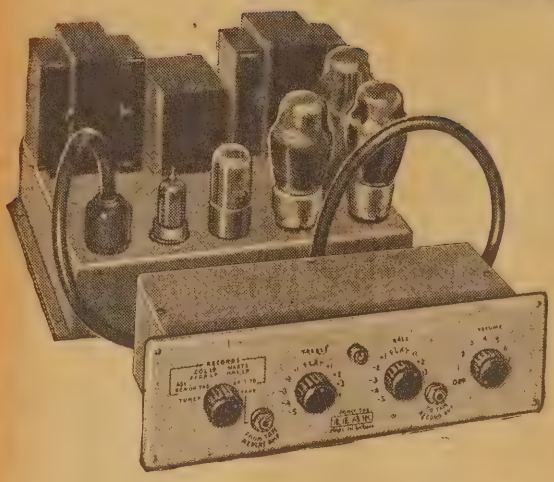
SUNDRIES

2 8-tag, 1 5-tag and 1 4-tag mounting strips, power flex and plug, nuts, bolts, star washers, solder lugs, solder, spaghetti insulation, hook-up wire, tinned copper wire.

THE NEW LEAK TL/10

COMPLETE WITH "POINT ONE" PRE-AMPLIFIER

Price 57 Gns. complete



SPECIFICATIONS

Circuitry: A triple loop feedback circuit based on the famous TL/12. The output transformer is the same size as in the TL/12.
Maximum Power Output: 10 watts.
Frequency Response: plus/minus 1 db 20 c/s to 20,000 c/s.
Harmonic Distortion: 0.1 pc, 1,000 c/s 7.5 watts output.
Feedback Magnitude: 26db. main loop.
Damping Factor: 25.

Hum: 80 db referred to 10 watts.

Loudspeaker Impedances: 16 ohms, 8 ohms and 4 ohms.

★ **Pickup:** The Pre-Amplifier will operate from any pickup generally available in the world. A continuously variable input attenuator at the rear of the pre-amplifier permits the instantaneous use of crystal, moving-iron and moving-coil pickups.

★ **Radio:** The radio input sockets at the rear permit the connection of any tuner unit. An input attenuator is fitted. H.T. and filament supplies are available from the pre-amplifier.

★ **Distortion:** Of the order of 0.1 pc.

★ **Hum:** Negligible due to the use of recently developed valves and special techniques.

★ **Input Selector:** Radio, Tape, Records ;and and all records can be accurately equalised.

★ **Treble:** Continuously variable, plus 9 db to -15 db at 10,000 c/s.

★ **Bass:** Continuously variable, plus 12 db to -13 db at 40 c/s.

★ **Volume Control and Switch:** The switch controls the power supply to the TL/10 power amplifier.

★ **Tape Recording Jacks:** An exclusive feature. Readily accessible jacks are provided on the front panel for instantaneous use.

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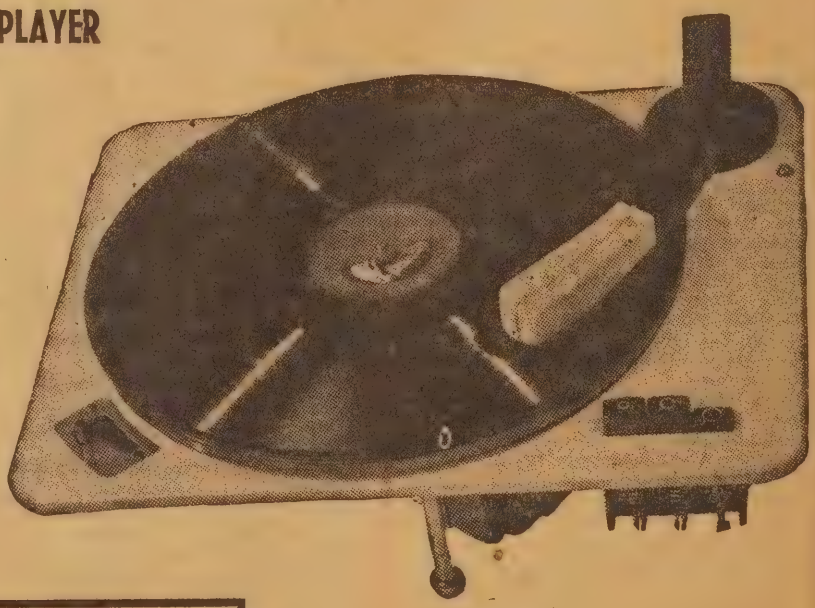

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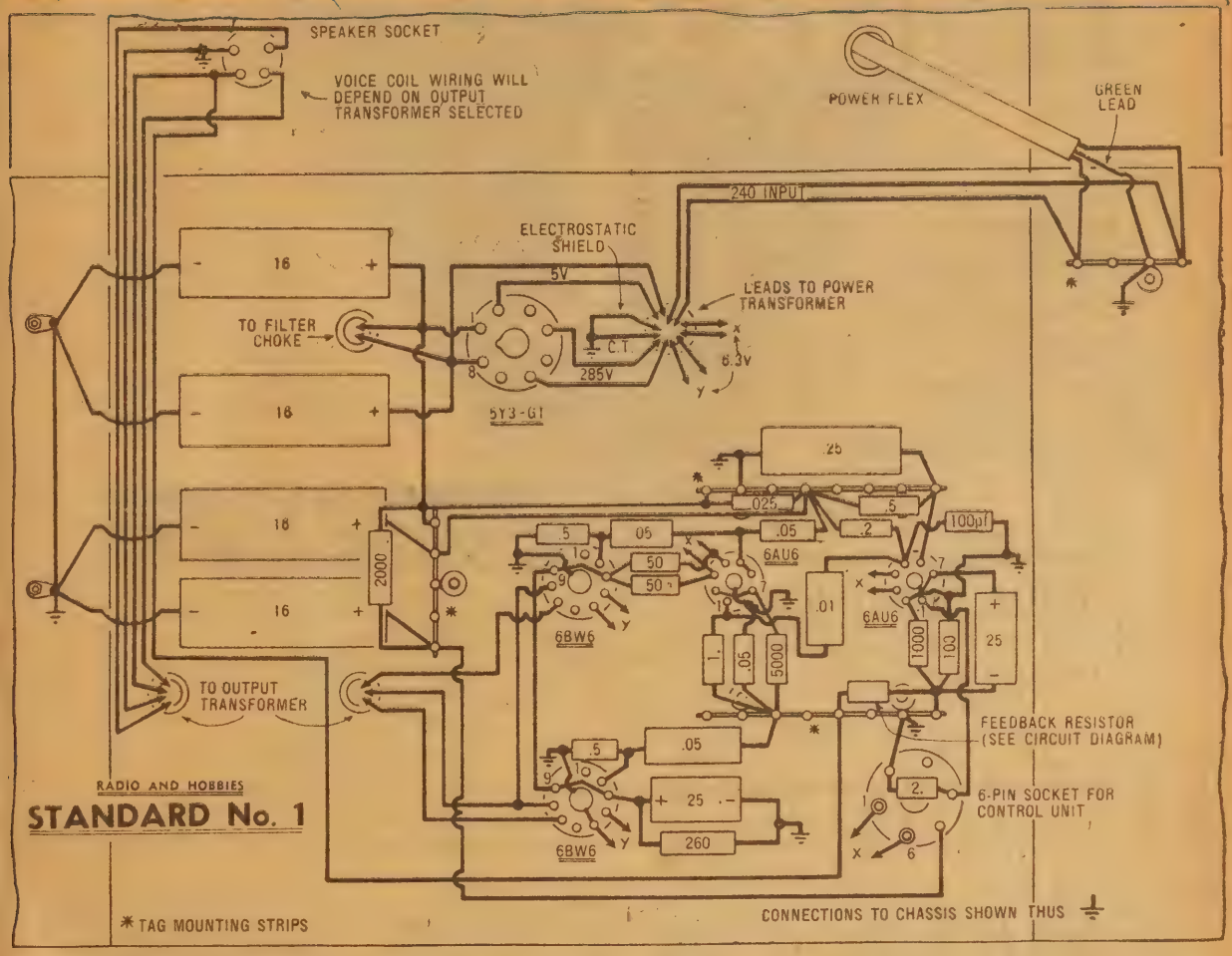
WIRING DIAGRAM OF THE NEW STANDARD AMPLIFIER



We do not usually prepare wiring diagrams for our amplifiers but this one proved rather easy to draw. It should greatly assist readers who are not too certain about working to schematic circuits. With one or two minor changes, the diagram also applies to the Playmaster Seven featured in the June issue.

turer's ratings, but the transformer still must be capable of handling adequate power at low frequencies.

It really boils down to the amount of iron in the core, and copper in the winding. Size is significant.

CHEAP TRANSFORMERS

The cheapest transformer will, undoubtedly, be the type which is sometimes available with the speaker, often for just a few extra shillings. While we have not taken these too seriously in the past, it is, nevertheless, true that the largest of these, designed for push-pull operation, aren't too bad.

On test, one such transformer gave a fairly level response from about 40 to 40,000 cps, the main weakness being a tendency to overload at about three or four watts in the 40-cycle region. At moderate power, however, it would be quite acceptable and well worth a trial if you want to get the costs right down.

Checking through the lists of brand line transformers, we came across a couple of types for medium power speakers such as the 12OX, which carry good frequency ratings and, on test, handle reasonable power at low frequencies. Transformers like this would be excellent for the usual domestic installation.

Some of the "PA" types carry more liberal power ratings, but have a more restricted response. With overall feedback, their response should also be quite good, though perhaps a few decibels below what we demand of high fidelity types.

The transformer in position when the photograph was taken is one made up specially for this amplifier. It has a primary impedance rating of 8000 ohms and a nominal power rating of 10 watts. It employs a sectionalised winding and it is the manufacturer's intention to release it with alternative secondary windings of 12.5 and 15 ohms for Jensen and certain imported speakers, or two and eight ohms for speakers in the Rola range.

These figures may also suit various other speakers.

The price of this transformer is a little higher than the PA types, but much less than the true "wide range". It is ideal for the "in-between".

Obviously, this leaves a good deal to individual choice, but, by selecting one of the less expensive speakers and an adequate — but not luxury—transformer to go with it, a very big sum can be sliced off the total cost.

At the input end the same kind of compromise has to be made. Pick-ups and motors vary in price by more than three to one, and, in general, performance and characteristics follow fairly closely on the price class.

There is the point, of course, that crystal pickups can get by with less overall gain than magnetics, but the story doesn't quite end there.

OUR APPROACH

Any design that we sponsor for general use should really be capable of accommodating both. Added to this is the desirability of achieving something like proper balance for radio and for the various types of recordings.

To cut a long story short, we reckoned that the best approach at the input end was to retain the style of the Playmaster amplifiers and provide for a control unit. In this way, we could get enough sensitivity for variable reluctance pickups like the

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new Goldring, without running into hum troubles.

Readers could provide a simple unit to start with and expand it later to suit themselves.

Our immediate suggestion, as you can see, is a modernised version of the original No. 1 unit. You can build it in a small box, as shown, or fit it into a larger one, with the idea of expanding it later.

Such then is the story behind the Standard amplifier, which should appeal to yet another large section of our readers.

In building the amplifier, we used the same chassis design as for the Playmaster amplifier No. 7, of the June, 1954, issue, while the control unit was made up on the same metalwork used for the Playmaster Control Unit No. 1, of the October, 1951, issue.

NEW BRACKET

Neither design required modification other than a new bracket for the control unit to take care of the smaller size of valve socket. We could have fitted a plate over the octal-sized hole in the original plate, but in bending up a new bracket we took the opportunity to reduce its depth from 2 7-8in to 2¼in, to make more room for mounting an indicator lamp, as in the Playmaster Control Unit No. 4, of the June, 1954, issue.

With the ready-made amplifier chassis, some drilling will be necessary to mount the power transformer, filter choke and output transformer. Due to the variation in position of mounting holes for different brands of these components, we thought it best to leave it to the individual constructor to drill the mounting holes and lead-through holes to suit the particular brand of components used.

However, we suggest that you mount the valve sockets in place before these heavy components are secured, simply because it is a little more convenient. Note that all sockets except the speaker socket have a particular orientation, as shown in the underchassis wiring diagram. This allows for a logical progression of the wiring and a neat and convenient layout of the minor components.

Make sure that the bolts holding the sockets, tag mounting strips and chassis earth points are in good contact with the chassis, bearing in mind that ready-made chassis are sprayed at the factory. A good idea is to use a star or spring washer, preferably the former, under the head or nut of a bolt, whichever is in contact with the chassis.

Some of the socket securing bolts will carry a solder lug. The underchassis wiring diagram will show which particular bolts are involved. Later, before you commence the main wiring job, all solder lugs, the metal surround of the larger sockets and certain earth lugs of the tag mounting strips may be connected together with a run of light gauge tinned copper wire to guard against trouble at a later date, should one or more earthing point fail to retain good contact with the chassis.

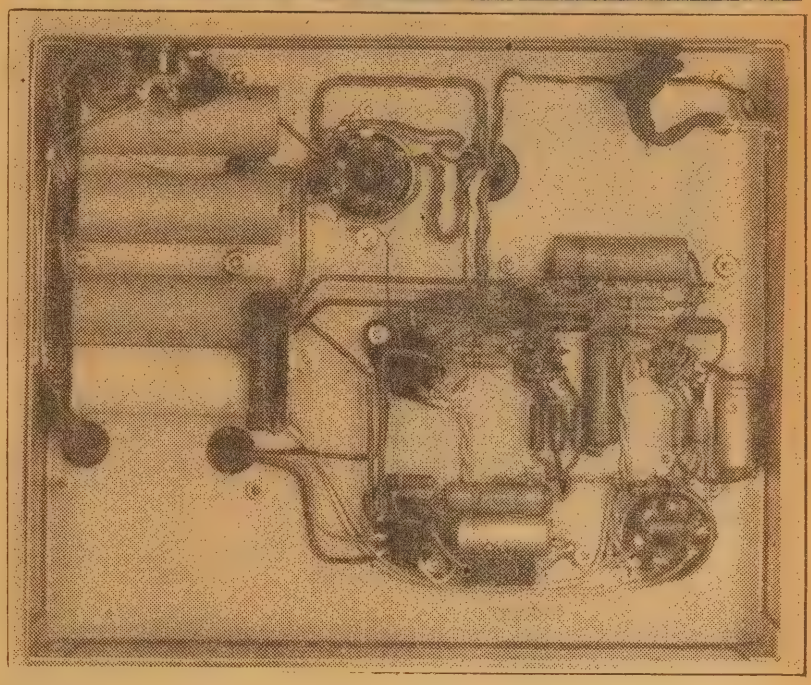
HUM PICKUP

Mount the power transformer and filter choke to the chassis, the power transformer position being behind the 6AU6 valves. Before securing the output transformer, a check should be made for hum pickup, if any, from the field of the power transformer.

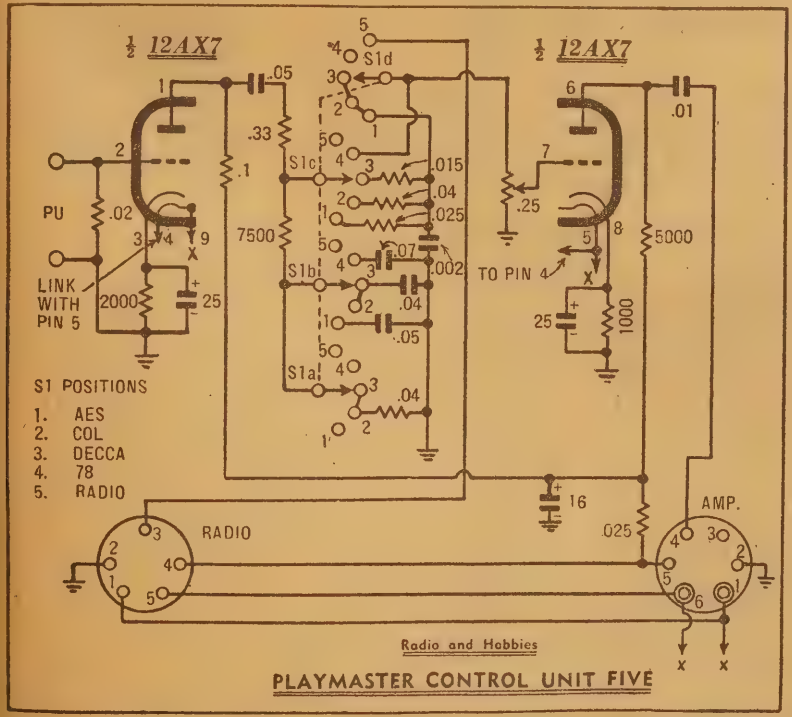
Although for this test you need only to connect the mains to the power transformer primary winding, you may as well, for safety sake, trim the other leads and lay them in place around the rectifier socket.

The earthing of the electrostatic shield of the power transformer is shown in the wiring diagram, but not in the circuit diagram. The incoming mains lead connects to the transformer primary at a tag strip secured to the side of the chassis.

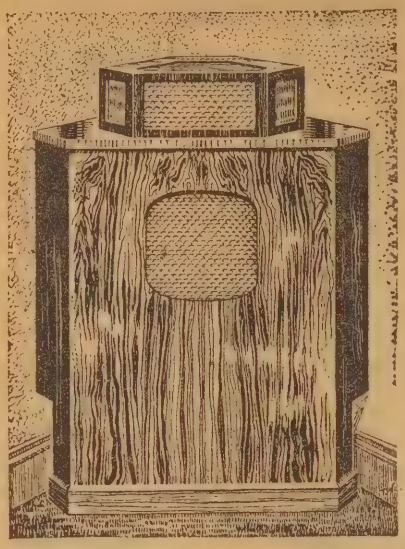
VIEW UNDERNEATH THE CHASSIS



And this is how the finished amplifier should look. Having wired the main amplifier with the aid of our wiring diagram you should be in a better position to tackle the control unit which goes with it.



Here is the circuit of the Control Unit No. 5 which retains the name "Playmaster". To build it, we simply stripped down the original Control Unit and rewired it to include specific compensation for the more important recording characteristics.



Sand-filled Corner Enclosure as recommended by Messrs. Wharfedale.

Illustration shows unit in use with middle and high frequency speakers facing upwards.

(N.B. This unit also recommended as the ultimate for the Super 12in CS/AL speaker and twin speaker systems.)

Wharfedale
LOUDSPEAKERS

Available to the trade throughout Australia:

WHARFEDALE Super 5": "Tweeter" for Twin- & 3-Speaker Systems.
WHARFEDALE Super 8"/CS: High Quality 8" Speaker.
WHARFEDALE Super 8"C/S/AL with Aluminium Coil. High Frequency Unit for Twin Speaker Systems.
WHARFEDALE 10"/CSB: Middle Speaker for 3-Speaker Systems.
WHARFEDALE 12"/CS: for Quality Reproduction as Single Unit Speaker or Bass Unit for Twin- or 3-Speaker Systems.
WHARFEDALE Super 12"/CS/AL: This is Messrs. Wharfedale's famous Single Unit Speaker covering the full Frequency Range, recommended where a Single Unit is preferred.
WHARFEDALE 15"/CS: High Quality Bass Speaker for either Twin- or 3-Speaker Systems (fundamental Resonance below 30 c/s).
WHARFEDALE Twin- and 3-Speaker Separators (Cross-over Networks), with built-in Volume Controls for High and Middle Frequency Speakers.

Several other models also available.

(Wharfedale Wireless Works are England's Leading Manufacturers of High Fidelity Loudspeakers.)

For all further information, we suggest you contact your Dealer.

SOLE DISTRIBUTORS FOR AUSTRALIA

Simon Gray
RADIO DIVISION

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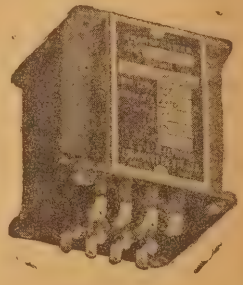
ELECTRONIC A & R EQUIPMENT

.. The Brand of Quality!



AMPLIFIER POWER TRANSFORMERS . . . FILAMENT TRANSFORMERS
SMOOTHING AND FILTER CHOKES . . . STEPDOWN TRANSFORMERS.
OUTPUT, DRIVER AND MODULATION TRANSFORMERS, FLUORESCENT
LIGHTING CONTROL GEAR . . . 32 VOLT TRANSFORMERS.

OUTPUT TRANSFORMERS

* Response Includes Correction due to Negative Feedback ** For use With Rola 12-OX Speaker.

TYPE AND MOUNTING	IMPEDANCE-OHMS PRIMARY	IMPEDANCE-OHMS SECONDARY	FREQ. DB+—	RESPONSE CPS	RATING WATTS	TYPICAL APPLICATION
894-23	500	2, 3.7, 8, 12.5	2	50-10,000	5	LINE TO VOICE COIL
900-22	2500 5000	2, 3.7, 8, 12.5, 15	1	*40-15,000	15	SINGLE 807, EL34, ETC, TO VC
896-9	8000 10,000	2, 3.7, 8, 12.5, 15	1	30-15,000	15	PP6V6G's A OR AB1 TO VC
897-9	8000 10,000	100, 125, 166, 250, 500	1	30-15,000	15	PP6V6G's A OR AB1 TO LINE
763-9	3000 5000	2, 3.7, 8, 12.5, 15	1	40-20,000	15	PP 2A3's A OR AB1 TO VC
809-26	500	2, 3.7, 8, 12.5, 15	1	50-20,000	15	LINE TO VOICE COIL
870-26	10,000	2 or 8	1	*20-20,000	6**	PP 6V6G's OR 807's AS TRIODES
871-9	10,000	2 or 8	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES
872-9	10,000	3.7 or 15	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES
891-22	6600	83, 100, 125, 166, 250, 500	1	50-12,000	35	PP 807's AB1 TO LINE
892-22	3200	83, 100, 125, 166, 250, 500	1	50-12,000	55	PP 807's AB2 TO LINE

DRIVER TRANSFORMERS

545-9	SE 4000 TO PP AB2 GRIDS 1.6:1. PRIM. TO ½ SEC RATIO 50-10,000 CPS 5 WATTS
588-6	SE OR PP 5000 TO PP 807's CLASS B. 200-5000 CPS 5 WATTS

A & R ELECTRONIC EQUIPMENT COMPANY PTY. LTD.

HEAD OFFICE, & FACTORY
TELEGRAMS: "ARLEC," MELBOURNE

378 ST. KILDA ROAD, MELBOURNE, VIC.
(OPPOSITE THE SHRINE) TELEPHONE: MX1150.

Note that 3-core power flex is shown in the wiring diagram to provide a connection between the amplifier chassis and the house wiring electrical earth system. The green-colored wire in the flex is usually considered as the earth wire.

Temporarily connect the secondary winding leads of the output transformer to the speaker through an appropriate length of lead and roughly position the transformer on the chassis, arranging the primary leads so that they do not short to themselves or to the chassis.

Plug the mains lead into the power socket, and, while listening in the speaker, choose a position for the output transformer which gives minimum hum induction. Ideally, the speaker should be mounted in its baffle or enclosure.

In our test, we found that we could mount the output transformer in a position which also suited layout symmetry as its field is not as great as the larger high fidelity types.

Incidentally, you should select your output transformer to suit the voice coil impedance of the speaker. Transformers are available to suit the nominal 2 ohm, 8 ohm, 12 ohm and 15 ohm impedance values, usually two values being available on one transformer.

TWO VALUES

In the underchassis photograph and wiring diagram, we have shown the wiring for two voice coil impedances going to the speaker socket. This anchors the unused leads and allows selection of impedance values according to the wiring to the speaker plug.

The two 6.3-volt windings on the 80 mA power transformers are employed to give separate heater circuits for the 6BW6 valves and for the 6AU6 valves and the 12AX7 in the control unit.

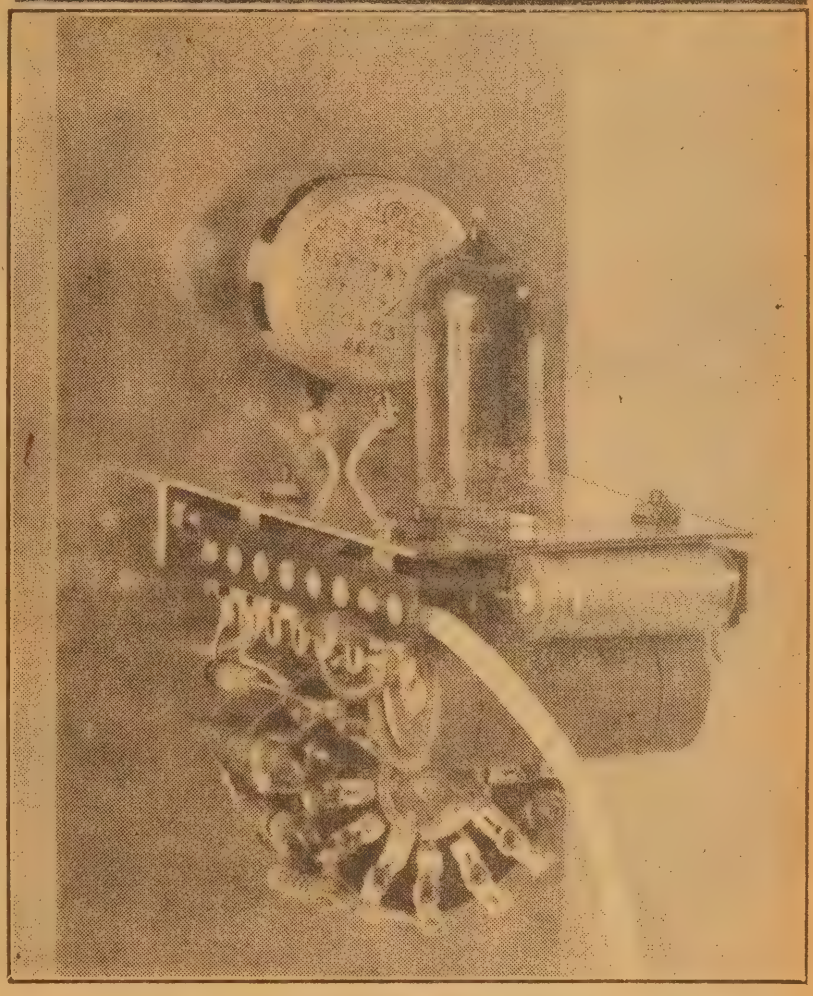
Unfortunately, the 80 mA size of power transformer does not normally carry a centre-tapped 6.3-volt winding, and it is necessary to provide an artificial centre-tap for the winding feeding the 6AU6's and the 12AT7 so that it can be held positive to the cathodes by the amount of bias supplied to the 6BW6's. This minimises hum injection into the early stages.

We used a pair of 50 ohm ½-watt resistors for this purpose. Lower values would need to be the 1-watt size. A 50 ohm centre-tapped wire-wound resistor could be used if available.

Before laying in the minor components, complete the heater circuits to the valve sockets and the 6-pin socket to the control unit and earth the centre spigots of all miniature valve sockets. One side of the heater circuit to the 6BW6's may be earthed via the spigot of one of the sockets.

The wiring diagram shows the use of tag mounting strips to provide convenient support for the minor components and their junctions. The junctions of the filter choke and the filter capacitors are made at pin eight and an adjacent pin of the rectifier socket.

INSIDE VIEW OF CONTROL UNIT



It is very difficult to illustrate properly the wiring of a control unit because it groups around switch contacts and valve pins. The safest approach is to set the switch to each position in turn, note the position of the wipers and wire each setting completely to correspond with the diagram. A mark on the panel to identify each position is also a good idea to save confusion.

PARTS LIST

1 panel 7in x 3½in with bracket 3½in x 2½in.
1 Case 6in x 3in x 3½in deep.
1 switch, 2-pole, 5-position, 2-section.

VALVES

1 12AX7 valve.
1 9-pin miniature valve socket, 1 6-pin and 1 5-pin plug and socket.

CAPACITORS

200VW 10 pc: 1 .07 mfd, .05 mfd, 1 .04 mfd, 1 . 002 mfd (some values obtained by paralleling).
Others: 2 25 mfd 40 PV and 1 16 mfd 350PV electros, 1 .05 mfd and 1 .01 mfd 350 or 400VW.

RESISTORS

½ watt 5 pc: 1 .33 meg., 2 .04 meg., 1 .025 meg., 1.015 meg., 1 7500 ohms.
½ watt: 1 .25 meg., potentiometer, 1 .1 meg., 1 025 meg., 1 .02 meg., 1 5000 ohms, 1 2000 ohms, 1 1000 ohms.

SUNDRIES

2 1½in knobs, panel light, holder and bezel (if required), 2 6-tag mounting strips, engraved front panel, shielded hook-up wire to pickup, 3 countersunk bolts and nuts, spaghetti, hook-up wire, nuts, bolts, solder, etc.

Watch the polarity of all electrolytic capacitors, remembering that the red end is positive.

There is not a great deal in the wiring of the amplifier and ample space is available. Try to arrange the components in a neat and orderly fashion. Take care with all soldered joins and see that scraps of solder do not remain where they may short portion of the circuitry to chassis.

WIRING

The wiring of the control unit is not difficult once you have allocated the sections of the switch to their various tasks. As a guide here, we combined sections S1a and S1d on the bank close to the clicker plate, with sections S1c and S1b on the outer bank in that order, that is, S1c is directly above S1a looking on the back of the switch.

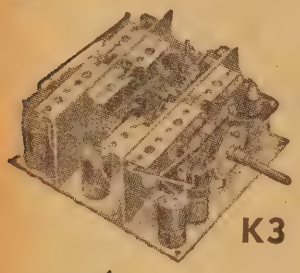
All earth connections of this switch are taken to the clicker plate for convenience. This does simplify construction, even though it conflicts with the theoretically desirable single-earth-point technique. There

(Continued on Page 108)

Hits in Kits

. . . by AEGIS

These Coil Assemblies incorporate components of the highest grade and can be relied upon for reliable and efficient operation.
Incidentally, every radio enthusiast should have the new Aegis Catalogue. Write direct to Aegis. Enclose 2/- in stamps.

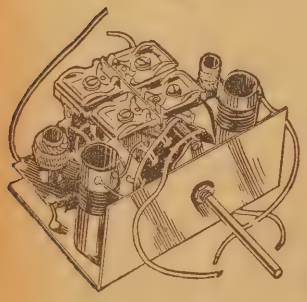


K3

TYPE K3: This triple wave coil assembly incorporates permeability tuned coils covering the B/C Band (550-1600 Kc.) and S/W Bands 13-42 and 40-110 metres. Constructed on sub-chassis, 5¾in long, 2 7/8in high, 5¼in wide. Efco dial type USL46, 3-band AWA available to match.
Type K3-S (not illus.) same as K3 but for 6SA7 or 6BE6 converter.

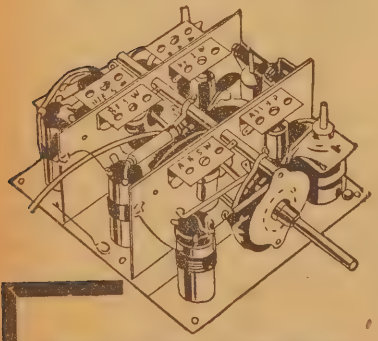
K1-M

TYPE K1-M: A midget dual wave assembly. Permeability tuned aerial and osc. for B/C (550-1600 Kc.) and S/W (7-23 Mc.) Ceramic trimmers for low loss and stability. Suitable for H and AWA gangs. 3¾in long, 1 5/8in wide, 1¼in deep. Fully color coded; midget in size and price. 6AN7 and 6AE8 only. Please specify converter valve when ordering.



K1

TYPE K1: A dual wave assembly incorp. permeability tuned aerial and osc. coils for B/C (550-1600 Kc.) and S/W (7-23 Mc.) trimmers and padder (fixed) condensers fitted. Iron core adjustment is made from above chassis (trimmers from beneath). Suitable for "H" & AWA gang. 2½in long, 3¾in wide, 1 7/8in high. For converters 6J8, 6A8, ECH35, EK2, IC6, 1R5. "Oak" type switch built in with 3in long x ¼in shaft.
TYPE K1-S (not illus.) same as K1 but for 6SA7 or 6AN7 or 6BE6 converter.



K2

TYPE K2: A dual wave assembly with same coverage as K1 type and incorp. RF stage. All coils permeability tuned and matched for AWA and H gangs. Constructed on sub-chassis, 5¾in long, 2 7/8in high, 5¼in wide. Concentric air trimmers fitted, also fixed capacity padders. S/W core adjustment from above chassis, B/C core and trimmer adjustment beneath chassis. "Oak" switch shaft, 1¾in long x ¼in dia.
TYPE K2-S (not illus.) same as K2 but for 6SA7 or 6AN7 or 6BE6 converter.

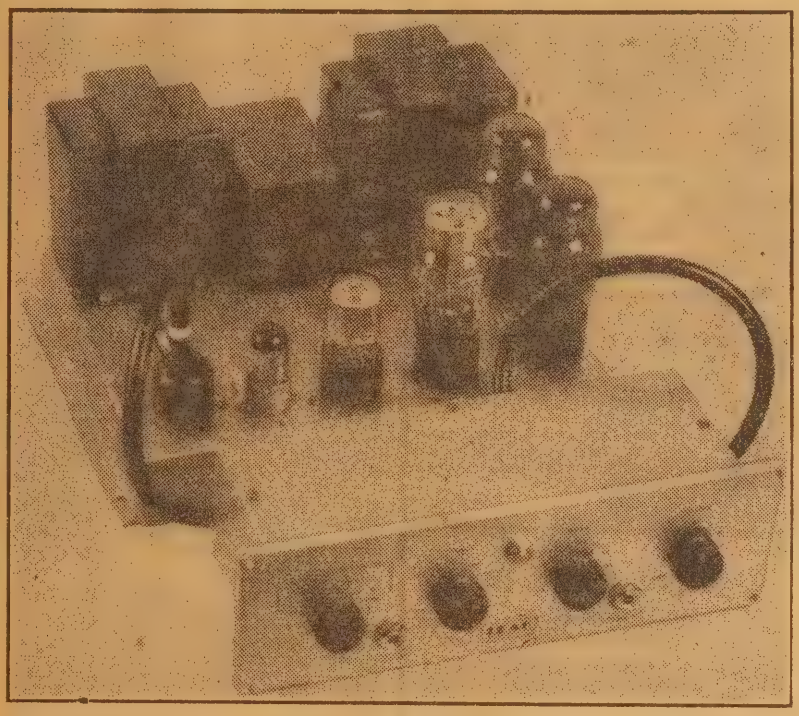
These Aegis Brand-Lines are available from your favourite dealer. Contact your nearest Aegis agent if you have difficulty in obtaining supplies.

AEGIS MANUFACTURING CO. PTY. LTD.
208 Lt. Lonsdale St., Melb. C1, Vic. 'Phone: FB3731.

- ★ **N.S.W.: Watkin-Wynne Pty. Ltd., 173 Pacific Highway, Nth. Sydney.**
- ★ **QUEENSLAND: Chandlers Pty. Ltd., Cnr. Albert & Charlotte St., Brisbane.**
- ★ **STH. AUSTRALIA: George Procter, 40 Pirie St., Adelaide.**
- ★ **WEST AUSTRALIA: A. J. Wyle Pty. Ltd., 1011 Hay St., Perth.**

TRADE REVIEWS AND RELEASES

LOWER PRICED LEAK AMPLIFIER



Leak amplifiers, as designed by H. J. Leak and made in England, have found a market all over the world, and a high reputation for quality. The original "Point-One" series is well known in Australia and distributed here by Simon Gray of 28 Elizabeth St., Melbourne.

THE new TL/10 amplifier has been made to sell at a lower price than the Point-One but retaining the high manufacturing standard of the earlier model. World-wide distribution has reduced the price so that in Australia, the amplifier and pre-amplifier sell for 57 guineas. It does not supersede the TL/12 and its slightly more elaborate pre-amplifier, but is aimed at a slightly different market.

HIGH CLASS

The specifications of the new job show that it does not lack the features which make a high class product.

The amplifier itself has an output of 10 watts and a harmonic distortion figure of .1 pc at 1000 cycles and 7.5 watts output—equal to any demand for home gramophone use.

Hum and noise are very low at -80 db, high input sensitivity, a damping factor of 25 and good stability margins. The output valves are connected in an "ultra-linear" circuit which gives high sensitivity and low output impedance. Lack of tropic proofing which is not needed in most cases, and lower output help to reduce the price over the larger model.

The pre-amplifier is particularly interesting in that it provides set compensation positions for standard 78 and LP playback curves, in addition to continuously variable bass and treble controls. A fourth knob controls the volume.

For tape enthusiasts, there is an input jack for use with a compensated playback amplifier, and a second jack permitting recording from radio or records when using a recorder embodying a low level recording amplifier. Connection is also possible for a radio tuner.

Two EF86 valves are used, having special low noise characteristics and freedom from microphonic trouble.

The amplifier and pre-amplifier are well made, and general construction is of a high order. Input sensitivity is 14 mV on the pick-up channel, which allows any pick-up to be used including low output types such as the variable reluctance.

ON TEST

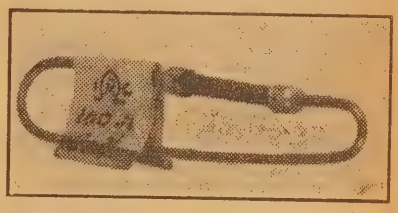
On test the amplifier gave its full output with rated inputs, had a very smooth overload and was very stable. The continuously variable controls have good characteristics, with a positive zero position, often lacking with such circuits. Input potentiometers for radio and pick-up allow adjustment of voltage to avoid pre-amplifier overload. Used with good pick-ups it sounded clean and impressive.

On all counts, the new Leak is a credit to its builders.

SPECIAL RESISTORS FOR VHF WORK

Of particular interest to the high frequency worker is a special line of resistors, recently announced by W. J. McLellan, having particularly good VHF characteristics.

THESE resistors are available in values from 30 ohms to one megohm, are rated at .25 watt, and are available in either 20 pc or 10 pc tolerances. Voltage across the resistors should be limited to 200 volts peak and the capacitance between terminals is .015 pf. The temperature coefficient is approximately minus .04 pc per degree C



over a range of minus 55 degrees C to plus 80 degrees C.

The resistors are constructed from a solid steatite ceramic rod to which a thin resistance film is permanently bonded. The wire lead terminals have cupped ends into which the resistor body is firmly cemented to form the axial pigtails. The entire unit is then protected with a coating of phenolic varnish. The resistor body is 9/16in long overall and .1in in diameter.

Curves issued by the makers indicate that the change in resistance at 30 Mc amounts to only a few per cent for all but the highest values and in all cases are substantially better than standard resistors.

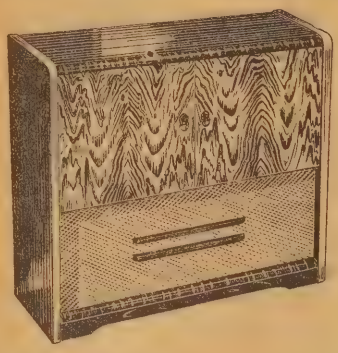
MINIATURE AEGIS COILS

Data recently to hand from the Aegis Manufacturing Co. indicate that they have developed a range of miniature IF's and coils having a very high performance.

THE makers claim that these coils have a higher performance than any other type of similar size and quote actual test figures in support of this claim. Of particular interest is a combination of IF transformers which provide an IF channel sensitivity of 12 microvolts for a power output of 50mW. The valves used were 6AN7, 6N8, 6DB7, and 6M5 and a normal negative feedback circuit was used.

These figures were obtained with the type J32, but the type J30 is intended to give similar high gain when used with 1.4 volt valves. The type J36 is intended mainly for manufacturers who find cost of prime importance, and is a lower priced unit having a performance only slightly below the J30 and J32.

MOTOR SPARES LTD



RADIOGRAM CABINETS

We have an extensive range of Radiogram Cabinets available in Walnut, Mahogany or Blonde Woods in nicely matched veneers. You can easily convert your old console or mantle radio to the latest in radiograms by fitting it to one of these cabinets with a Microgroove Record Changer or Player.

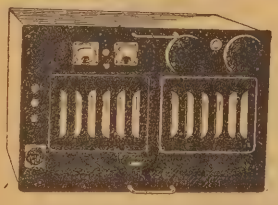
Price from £15/10/-

Models available both front opening and lift up lid types. Prices and Photos on application.

CHIEFTAN MULTIMETER

For the radio repair man, amateur, experimenter, motor mechanic and electrician. This pocket size multimeter is ideal. DC voltage readings 0-15, 0-150, 0-300, 0-600, Ohms scale 0-10,000 ohms. The dial is exceptionally easy to read and the meter will stand up to any amount of hard work.

Price £3/19/6
Weight 1lb.



A.T. 300 TRANSMITTER

Radar Transmitter uses the following parts:—3—AV11 valves, 2—cyclatron valves, 2—4 ceramic socket, 1—24 volt motor, 2—01-5000 volt working condenser, 1—02-10,000 volt working condenser, 1—001-5000 volt mica condenser, 3—heavy duty transformers, 1—0-100 volt AC meter which is 0-1 MA movement with 1 MA dry metal rectifier fitted, 1—0-5 MA, DC, meter, and many other parts, such as stand off insulators, coils, etc. Worth £30.

Our price £4/19/6
Weight 80lb

CARBON RESISTORS

All brand new and in good condition as listed.

1 Watt Resistors listed in ohms. 250, 300, 350, 400, 450, 500, 600, 650, 800, 850, 1000, 1500, 2000, 2500, 3000, 4000, 4700, 5000, 6000, 10,000, 12,000, 15,000, 20,000, 25,000, 30,000, 40,000, 60,000, 70,000, 75,000, .1 Meg, .15 Meg, .2 Meg, .25 Meg, .3 Meg, .5 Meg, 1.5 Meg, 2 Meg, 2.3 Meg, 3 Meg, 5 Meg.
Price only **4d each, 3/- doz. £1 per 100**

½ Watt Resistors listed in ohms. 50, 250, 300, 500, 600, 2000, 10,000, 25,000, 30,000, 40,000, 50,000, 60,000, .1 Meg, .25 Meg, .3 Meg, .5 Meg, 2 Meg, 3 Meg, 5 Meg.
Price only **3d ea., 2/6 doz., 16/8 per 100**

¼ Watt Resistors listed in ohms. 250, 300, 320, 350, 450, 600, 750, 800, 1000, 1200, 130,, 1900, 2000, 2400, 2500, 2600, 2700, 3000, 3200, 4300, 6500, 7500, 7900, 8000, 10,000, 13,000, 15,000, 25,000, 37,000, 40,000, 50,000, .1 Meg, .15 Meg, .16 Meg, .3 Meg, .35 Meg, .4 Meg.
Price only **3d ea., 2/3 doz., 15/- per 100**

You may make up an order for assorted sizes of the same wattage, as you require them and obtain the concession quantity price.

WIRE WOUND RESISTORS

Bargains in Wire Wound Resistors as follows: 3 Watt sizes in ohms. 7, 12, 21. Price 8d each:

5 Watt sizes in ohms. 100, 200, 450, 750, 1200, 1250, 1500, 2000, 3500, 4500, 5000, 9000, 10,000. Price 9d each.

10 Watt sizes in ohms. 125, 150, 300, 750, 1250, 1500, 1750, 2000, 2500. Price 1/- each.

12 Watt sizes in ohms. 450, 5000, 8000, Price 1/3 each.

20 Watt sizes in ohms. 50, 75, 125, 150, 175, 200, 250, 300, 400, 500, 750, 1250, 1750, 4000, 7500 17,500. Price 2/- ea.

25 watt available in the following sizes: 50, 75, 100, 125, 175, 200, 250, 300, 400, 750, 1250, 1750, 3000, 4000, 7500, 12,500. **Price 2/6 each.**

BRITISH NAVY RESISTORS

available as follows:

Resist.	Watts	Tapped or Untapped	Price
50	10	Untapped	2/- ea.
100	40	"	4/- "
250	20	"	2/6 "
300	85	"	5/- "
350	25	Variable Tap	3/- "
700	20	Untapped	2/6 "
2500	10	"	2/- "
3750	30	"	2/6 "
4000	20	"	2/6 "
5000	20	"	2/6 "
5000	27	"	2/6 "
10,000	55	Tapped at 3000	5/- "
12,500	20	Untapped	2/6 "

MICA CONDENSERS

The following **MICA CONDENSERS** all of well known make, are brand new.

Cap.	Type	Each	Doz.
.0001	Silver Mica	6d	4/-
.0002	Mica	7d	4/6
.000325	Ceramicons	9d	6/-
.0004	1500V Mica	1/-	10/-
.0008	Mica	9d	6/-
.0012	"	9d	6/-
.0015	"	9d	6/-
.002	"	10d	8/-
.0025	"	10d	8/-
.003	"	11d	9/-
.004	"	11d	9/-
.005	"	1/-	10/-
.006	"	1/-	10/-
.008	"	1/-	10/-
.01	"	1/6	15/-
.02	"	2/6	20/-

★ SPECIALS ★

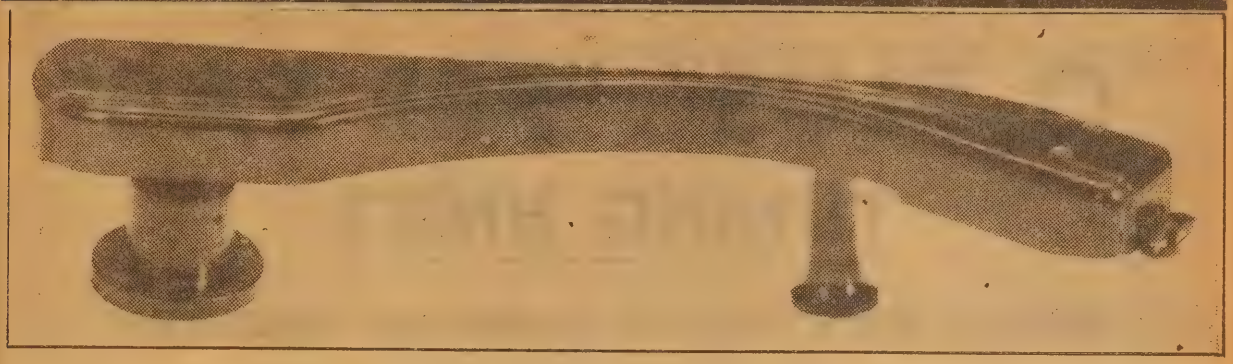
1. **Resin Cored Solder,** 1½oz Packets Ideal for Radio work. Worth 2/3. **Our price 1/3.**
2. **Padder Condensers.** Suitable for for 455 KC Oscillator circuits. Adjustable. Worth 2/9. **Our price 1/3.**
3. **Super Stripper** designed especially for plastic and rubber covered cable stripping. Fast and efficient. **Only 2/9 plus Sales Tax.**
4. **U1 Speaker transformers** 30,000, 20,000, 14,000, 10,000, 7000, 5000 2500 ohm primary to 2.3 ohm secondary. Especially designed for Universal speaker transformer. Worth 72/-. **Our price 29/6.**
5. **Twin Plastic Parallel Pair Bell Wire. Price 16/8 100 yards.**
6. **Field Coils for Rola 8in Speaker.** These contain over 1lb approx. of 28 gauge enamelled wire in perfect condition, suitable for many electrical and radio coil winding jobs: **Only 7/6 each.**
7. **3 Speed Gramophone Motors,** well known English make with heavy turnable, adjustable knob changes motor speed to 33, 45 or 78 rpm. Ideal for playing all kinds of records. **Worth £8/10/-. Our price £5/10/-.**
8. **Spring Gramophone Motors.** This excellent little wind up motor is suitable for replacement in portable gramophones or combined portable radio and gramophone. Complete with turnable and fittings. **Only £3/10/-.**
9. **Single Pole Toggle Switches.** Single hole mounting bakelite body and toggle, suitable for operation on 250 volts AC. Worth 7/6. **Our price 3/3 each.**
10. **Dry Metal Rectifiers,** meter type suit 0-1, or 0-5 ma meter. Brand new. Worth 37/6. **Our Price 25/-.**
11. **Genemotors** PE 94A. Input 28 volts, output 300 VDC at 260 ma, 150 VDC at 10 ma, 14 volts DC at 5 amps. Enclosed in a metal box with cooling fan, could be converted to 32 volt motor. **Price 25/- each.**
12. **0-50 ma Meters.** Brand new English Meters, boxed and perfect. Square dial with 2in scale. Ideal for multimeters, etc. Worth £3/10/-. **Our price 18/6.**
13. 0-20 volt meters—similar to above. **Price 19/6 each.**
14. **0-1 ma meters 100 ohms per volt,** square face, 2in scale. An excellent meter for building multimeters. **Price 32/6 each.**

NOTICE

All parcels sent registered post unless otherwise stated. Postage or freight must be included with order.

547 ELIZABETH ST., MELBOURNE ALSO AT — ALBURY ARARAT BAIRNSDALE BALLARAT BENALLA BENDIGO BROKEN HILL COLAC DANDENONG ECHUCA SALE FRANKSTON GEELONG MILDURA SHEPPARTON ST. ARNAUD WAGGA WANGARATTA WARRAGUL

GOLDRING RELEASE VARIABLE RELUCTANCE PICKUP



The new Goldring variable reluctance pickup.

A new pickup announced by Goldring marks a breakaway from their popular Headmaster series and others. It is a variable reluctance pickup with a very good performance.

BECAUSE of its good response and reliability, this type of pickup has proved very popular overseas, although the Goldring is the first one to be obtainable in Australia in any quantity.

The cartridge is mounted in a bakelite arm, counterweighted and balanced to give low stylus pressure on both LP and 78. It is of the turnover type, but the armatures are not connected together.

Response curves of three cartridges submitted for test showed virtually flat response from 40 cycles to 10 Kc with varying rises beyond that point to about 13 Kc. Useful output on LP appears to be nearly 20 mV., and on 78 somewhat better.

However, no noticeable reflections of peaks show up in the waveform, which is particularly clean over the full range.

Tested on normal recordings, the pickup played cleanly and well, with very good bass. Output is not high, but it will load our last Playmaster with adequate volume, and operates well with commercial jobs.

It should be very popular for those looking for a moderately priced, wide-range pickup for amplifiers with adequate gain.

ELECTRIC VAPORISER FROM ROLA

Recently announced by Rola Special Products Pty. Ltd., The Boulevard, Richmond, Victoria, is the Toxit Electric Vapouriser for use with Toxit insect-killing tablets.

THIS method of attacking insect pests is relatively new and has several advantages over the older methods. Briefly, it involves the heating of tablets, which give off fumes highly toxic to insects, though otherwise harmless. The vaporiser is energised from a power point.

It is claimed that one tablet, vaporised in an ordinary sized room, will spread a microscopic film over the walls, &c., which will retain its killing properties for at least a fortnight.

The sample submitted was tested in a particularly bad mosquito-infested area, and can fully justify the claims made for it.

"SCOTCH" REELS SPLICING TAPE

W. J. McLELLAN & CO., PTY. LTD., agents for the well-known Scotch Recording Tape, announce two new products under this trade mark.

The first is an improved version of the original MC2-111 Scotch Recording Tape, and, although it carries the same type number, is a much improved version. Among these improvements are a thinner, but stronger base material, a lower noise level, greater sensitivity, minimum stretch, and ease of splicing.

To go with the new tape is a new spool, design to minimise the many troubles which can arise in handling and winding tape. This spool has a larger hub—2¾in in diameter—to reduce winding tension, a V slot for ease of loading, warp-free reinforced rims, and is of more robust construction than the older type.

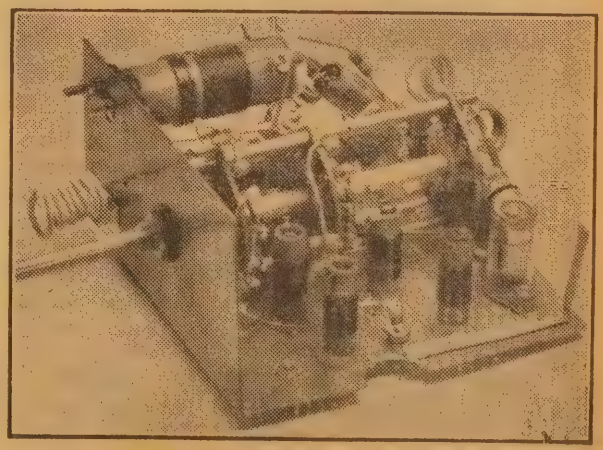
Price of the new tape is 70/- for 1200ft and 45/- for 600ft.

The second product is a slicing tape specially designed to overcome the problems of joining recording tape. It has a thin backing with non-ageing properties, and is unaffected by normal variations of in temperature and humidity.

It is available in widths of 7-32in ¼in and ¾in, and in reels of 66ft or 150in.

NEW TRIPLE-WAVE COIL BRACKET

KINGSLEY'S new multi-band coil bracket. Bandspread on 31, 25 and 19 metres plus b'cast. Ready-wired converter socket, and pickup switch position. No RF stage. Iron cored coils and nice aerial b'cast coil. Well made and priced — it looks good!



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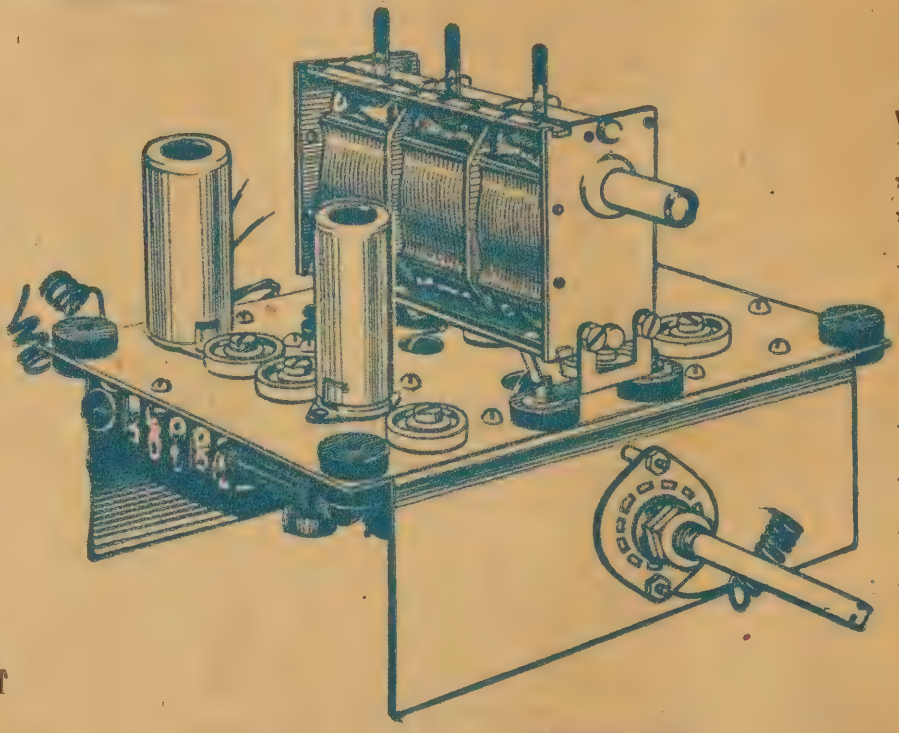

"Q-PLUS" TYPE TWR5 PRE-FAB UNIT

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2. 2.8 — 8.0 M/cs
3. 7.5 — 23.00 M/cs

4th position Gramophone and dial.

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SPECIFICATIONS Iron cored coils throughout using latest 6 mm carbonyl cores, moulded polystyrene formers, iron clad aerial, R.F. coil, on B/C band TWR5 requires 6BA6 RF 6AE8 converter valves, triple wave dials are available for above coverage from your distributor.

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NEW MINIATURE CAPACITORS

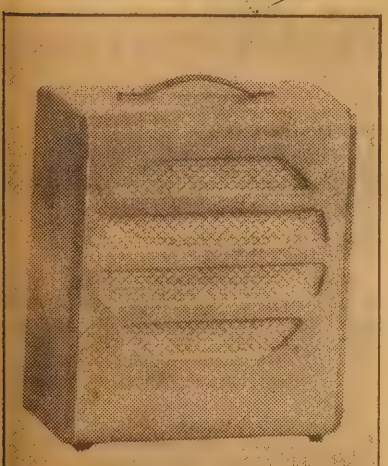
UCC have released an attractive new line of sub-miniature 400 volt dc working Paper Tubular condensers, type PWS.

THESE sub-miniature units have been developed to fulfil an ever increasing demand for smaller components. The reduction in size is achieved by special design of standard foil-paper construction, and not by a metallising process.

The wax coating is suitable for operation up to 70 degrees C., although the capacitors themselves are rated for full operation at 80 degrees C. Should they be required for higher temperature working, then the applied voltage should be derated to 300 volts at 70 degrees C.

A Technical Bulletin, No. A1-101, giving the salient details, is available from U. C. C., 433 Punchbowl Rd., Enfield, NSW.

P.A. CABINET



FINISHED in two-tone leatherette, cabinets as illustrated above are available for the Radio and Hobbies 10-Watt P.A. System, featured in the September and October issues, 1953. They can be obtained on immediate demand by radio supply houses from the manufacturers, Messrs. Gibbons and Denham, 15 Faviola St., Nth. Lidcombe, NSW.

ALARM SWITCHES ON THE RADIO

Maybe you have often groaned when awakened by a jangling alarm clock which frays your nerves and gives you a bad start for the day.

MAPPS MAGIC BOX is now available which ensures that you are coaxed from your sleep by your favorite morning radio program instead of by the alarm clock itself.

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The Magic switch box is sold for fitting to the "Westclox Lark", Westclox Spur", "Weltime" and British made "Sunrise" alarm clocks.

It is very easily fitted, so that the purchaser can make the attachment at home. The retail price is 39/6 which includes fitting if you so desire.

The box is also sold already fitted to "Westclox Good Morning", and "Westclox Bell-bird", the price being £3/14/6 and £4/10/- respectively. This handy gadget should find a ready sale.

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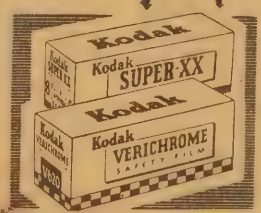

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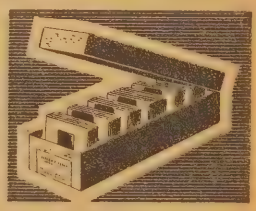

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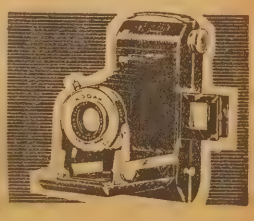

Let's Buy An Argument

Since this series of articles first made its appearance in the magazine, several years ago, readers have gradually come to expect us not only to create arguments but to settle them as well! It isn't unusual for people to ring us at odd times during the day to test a proposition or request a verdict on some argument that has been in progress in a factory or (hushed tones) in a Government department.

by Neville Williams

IT'S all very nice and very flattering when the subject matter is purely radio, about which we're supposed to have a few clues.

But it can be very awkward when the argument revolves around some more remote and abstract branch of physics, barely related to radio.

Unless one has made an intensive study of the particular subject, one's ideas on it are likely to be based purely on the conventional textbook approach. Of the limitations of such an approach, the short-cuts and even the occasional inaccuracies, one remains blissfully unaware.

NOT ALWAYS EASY

Thus, when faced with an argument or proposition, which challenges the conventional approach, it isn't always easy to make a snap judgment and say that the proposition is definitely right, definitely wrong or even feasible.

How often have you seen published in the daily Press experts' comments on some new idea? As often as not, the said comments are a masterpiece of wordy evasion. They don't like to say, "I don't know," and they don't like to commit themselves either, in case they say the wrong thing.

Sometimes the said new ideas, arguments and propositions are suspiciously like the product of a mind which simply can't bring itself to accept the conventional approach.

Sometimes they represent a hotch-potch of half-truths which take quite a bit of sorting out.

Then, again, they may conceal an important scientific possibility which you suspect the sponsor is groping after, rather blindly.

Hence the caution.

Without trying to identify his literary efforts with any of the above classes, I can quote by way of an example the efforts of an English reader, who called in to see me a few weeks back.

Having expressed his relief at not having to live permanently in Australia, and having quoted his association with various societies, he proffered several closely typed sheets which purported to explain all kinds of "mysteries" about the nature of our world and the universe at large.

I did not retain all the material, but I do remember that he had worked out that the interior of the earth became progressively colder toward the centre, contrary to popular scientific belief.

Now I've never been to the centre of the earth and I've never had to make a special study of the problem, but I have read enough to understand that the "popular" belief is held by some very learned men.

In fact, it seems to be accepted almost universally that the centre of the earth is extremely hot and extremely dense, the main difference of opinion being in regard to the precise form and constitution of the core.

I understand that scientists are trying to weigh up the evidence of seismographic and other tests in an effort to resolve the matter.

QUERIES FOLLOW

When, therefore, a private individual chooses to adopt the reverse view and to assert without any reservations that the world's scientists are on the wrong track, he must expect to be treated with some reserve.

Sufficient to say that I did not try to assert my official status as technical editor and prevail upon the editor to scrub all articles in the front of the next issue in favor of this new material.

But just in case you might be looking for a little mental exercise, we have reproduced on the opposite page a selection of the same gentleman's opinions on matters more akin to our common interest — the

nature of electricity. I suggest you read them through at this juncture.

What of the first proposition? Is it a profound statement, badly worded, a poor summary of what scientists are thinking anyway, a collection of half-truths or mere nonsensical scientific jargon? Or should I define it some other way?

There is, of course, a fundamental connection between electricity and magnetism. At the very least one is an automatic product of the other.

FUNDAMENTALS

At this very moment, scientists are trying desperately to solve the riddle of the electron. It is a charged particle and, if so, what is the precise meaning of the term charged? Or again, is the electron merely a kind of wave train which behaves in some ways as we would expect a particle to behave?

What is a particle, anyway?

Until questions like this are solved it is rather futile to quibble about the meaning of terms. On the other hand, our friend may maintain that he is not quibbling about terms but seeking to order his thinking by the best use of words as we now understand them.

See what I mean?

Unfortunately, for his line of argument, the second item on proton will sound very unconvincing to anyone familiar with circuit concepts.

A copper atom remains just a copper atom, irrespective of whether it happens to be in a wire at earth potential or thousands of volts positive or negative with respect to earth.

The thing that really counts is not the potential difference between the "parts" of an atom and some remote external reference point but the balance of charges within the atom itself and in reference to those atoms immediately adjacent to it.

Any potential difference which might exist between the earth and heavenly bodies (I won't get involved in that one) doesn't affect the premise that, as far as we are concerned, protons still look positive and electrons still look negative!

Item 3 leaves me with the sneaking suspicion that our correspondent should refresh his memory on the facts of electron emission. Either that, or our valve manufacturers have been deluded into thinking that electrons can only be successfully launched into space through a near vacuum!

WHAT ARE ELECTRONS?

If the second part of this observation means anything at all, it does not disprove the electron theory as such but merely expresses an opinion on the nature of the electron. As we said before, scientists have been busily speculating on this for some time.

Observation (4) should really rock the world of science, though I feel that its sponsor owes us a little more detailed explanation of his phrase "through ordinary vibrations at certain frequencies". I feel that it's just a wee bit vague!

As for observation 5, our correspondent can dispense with gravity if he likes but I'd prefer to go on using it myself for the time being. It helps keep my overcoat down in cold weather!

Just by way of a check, however, I looked it up in the technical dictionary and failed to find any reference to a "mystical force". In fact it is defined as "That force of nature which manifests itself as a mutual attraction between masses . . ."

That could even mean the form of terrestrial magnetism which our friend has gone to such pains to "discover". Perhaps science isn't quite so out of date after all!

More in our line is the letter from E.S. in North Queensland, which has been awaiting an answer in these columns. E.S. should long since have received his direct answer but the problem, with variations, has often stumped the less experienced readers.

In fact, you might like to read the letter in question ("Beat Frequency Oscillators" page 87) and see whether the explanation comes immediately to mind.

As far as E.S. is concerned, the error lies in the fact that he has assumed the signal frequency in the I.F. channel to be fixed. If it were so, the beat note certainly could not vary in pitch. An I.F. signal at say 455Kc would beat with the BFO at say 456Kc to produce a 1Kc beat and this note could only be varied by altering the setting of the BFO control.

In point of fact, the signal in the IF channel does vary in frequency with the receiver tuning

THE NATURE OF ELECTRICITY (3)

(1) What is the difference between magnetism and electricity? Is it possible to define electricity?

There is no fundamental difference whatsoever between magnetism and electricity. One is a degree of the other. Take, for example, an ordinary wire leading to an electric light bulb. If this wire is severed, the bulb will be extinguished, i.e., if there is a break in any circuit, no power will flow.

Let us now study what happens inside a radio valve, using for this experiment a two electrode or diode valve. We know that unless there is a continuous conductor in a circuit, no power will flow. As the inside of the valve is a vacuum, what is commonly known as current, cannot flow.

But, you will say, we measure milliamperes in the anode circuit with the aid of a milliammeter, which measures current flow.

What actually happens is this: As current cannot flow without a conductor and the only possible force that can flow without a conductor in a vacuum, is magnetism, it should be quite clear that the only force which can be measured in a milliammeter, or any other meter, is magnetism.

Therefore, we can say that electricity as such is merely concentrated magnetism, or, in other words, electricity is a degree of magnetism, magnetism being the basic force.

It should be noted that if a substance cannot be broken down into further separate entities, the basic substance must have been reached. Magnetism and electricity cannot exist separately, because they are one and the same thing.

(2) What, then, is a proton?

A proton is defined as the smallest possible charge of positively charged electricity, equal in size to an electron, and weighing 1840 times as much as an electron, &c. Now let us take this definition from a practical point of view and analyse it.

The Earth is "negative" with respect to the Sun, which in turn is "positive" with respect to the Earth. In other words, the Sun and the Earth are of opposite polarity. It is known and has been proved that any and every part or point on the Earth is "negative" with respect to the Sun.

That is, the whole Earth is "electronic" as it were, completely formed of "negative" charges of electricity with respect to the Sun. Where one would suddenly find a "proton" on the Earth—I do not know, i.e., a "proton" does not exist.

(3) What, then, is an electron?

An electron is defined as the smallest possible charge of negative electricity, &c. Again, let us investigate.

When matter is heated, it is supposed to give off particles known as "electrons". If this were so, materials used for supplying heat, light, &c., especially those in constant use, would have an extremely short life. Particles are ejected from hot bodies but as the heat is energy—all energy being electromagnetic — the particles given off are merely due to the vibration of the material at a frequency which causes partial disintegration. If anything is moved to and fro fast enough, heat will be given off. This is energy.

Therefore, electrons, as such, cannot exist.

(4) Then, can you explain the electron theory?

As this is a theory based on something that has been found to be untrue, the electron theory can no longer exist, even as a theory. Matter does not fly around in circles, &c., the heat in any body is merely through ordinary vibrations at certain frequencies.

(5) What is gravity?

Gravity, as some mystical force, cannot exist. Only forces that can be measured practically can exist. The gravity of the Earth is measured in dynes/cm. and, e.g., at London 981 dynes/cm. This is a magnetic measurement, and must, therefore, obviously measure magnetism, which, as the Earth is a huge magnet, measures the magnetic pull of the Earth.

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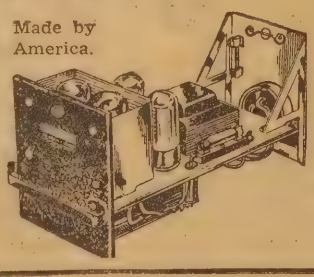

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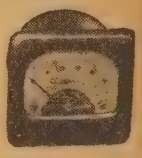

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and this is the key to the whole situation.

The ex-sergeant's ideas about sidebands are completely wrong, as also are those put forward by E.S. himself.

To take a typical case, we may consider a superhet with a 455Kc IF channel and a beat oscillator set exactly to 455Kc.

If this set were now tuned exactly to a station on 1000Kc, the local oscillator would naturally be on 455Kc, the IF signal would be 455Kc and this would be at zero beat with the BFO.

If the dial were now shifted ever so slightly, it may for example change the oscillator frequency to say 1455.5Kc. The tuning of the aerial circuit would also be affected slightly but not enough to reject the incoming signal.

AUDIBLE NOTE

However, this signal on 1000Kc would now beat with the local oscillator on 1455.5 to produce a signal in the IF channel of 455.5Kc. This, beating with the 455Kc from the BFO, would result in an audible 500-cycle note.

A further shift in oscillator frequency might similarly produce a 1000-cycle beat note and so on up the scale.

In a normal IF channel the beat note will pass from just about the limits of audibility, through zero beat to a similar limit on the other side of resonance.

With highly selective IF channels, particularly those using a crystal filter, the attenuation of signals away from 455Kc increases rapidly and the note may diminish in amplitude quite rapidly as it rises in frequency.

In fact, by setting the BFO just off resonance with a very selective IF channel, a "single-signal" effect can be obtained, the changing beat note being heard for the most part only on one side of the tuning position.

However, this is going beyond the question put by E.S. We hope he managed to avoid the manslaughter. At least it didn't appear in the papers!

Yet another argument has been referred to us by a reader in South Australia. He makes no mention of impending bloodshed but I can assure you, from past observation, that this is chosen subject can lead to some quite lively argument.

TRANSFORMER PROBLEM

Referring to the illustration as under he writes:

Dear Sir,

I would be pleased if you could supply the answer to the following problem.

An output transformer has a split secondary winding as shown, each half being the same, the total winding being intended to match into 2000 ohms.

Thus, if B and C are joined together and the load connected to A and D, the impedance is 2000 ohms.

If the load is connected to A and B only, the impedance is 1000 ohms.

If A and C and B and D are joined together and the load is connected to A and D, the impedance is 500 ohms.

Now the question is, if the secondary windings are removed on to a bobbin and rewound on to the former again as a single winding, using the two wires in parallel, what will the resulting impedance be, 500 or 1000 ohms?

Thanking you in anticipation, A.G.M.

On the surface, this looks like a very tricky problem but it breaks down completely if you remember just one simple and basic rule:

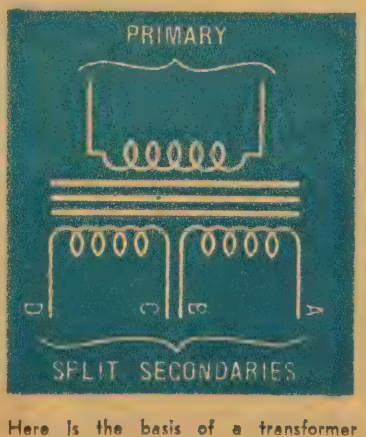
The relative impedance of a winding on a transformer varies in proportion to the SQUARE of the turns ratio.

Let's see what this means: A.G.M.'s first postulation is that the total winding A to D is intended to match a load of 2000 ohms. No difficulty about that!

HALF THE TURNS

If now we disregard C-D and consider only winding A-B as being active, we have virtually halved the number of secondary turns.

But remember that the relative impedance varies as the square of the turns ratio. Since we have halved the number of active turns, the impedance ratio will now be equal to ½ squared, which is ¼. Therefore the impedance into which one half secondary should match is 500 ohms, not 1000, as A.G.M. suggests.



Here is the basis of a transformer problem put to us by a reader from South Australia.

To put it another way, if we reduce the active turns by a factor 2, then the equivalent load will reduce by 2 squared, or 4 times.

To obtain an effective secondary impedance of 1000 ohms, one winding would have to be tapped in such a way that just over 0.7 of the total number of turns was accessible.

The reason? Well, 0.707 squared works out at 0.5—the impedance ratio we want!

A.G.M.'s third query is what happens when the two windings are connected in parrellel, A to C and B to D. In point of fact, the answer is "very little".

To understand why this is so, it is merely necessary to realise that the winding A-B delivers a certain signal voltage to the load. This represents the transfer of a certain amount of power and a certain reflected load on the primary circuit.

Connecting an identical winding C-D in parallel with A-B will not change this signal output voltage, any more than the output voltage is changed when you connect two 6.3-volt heaters windings in parallel on a power transformer.

LOAD UNCHANGED

Since there is no change in output voltage, there is no change in the power loading on the primary and therefore no change in the reflected impedance.

The only difference would be a reduction in the DC resistance of the secondary circuit and a slight improvement in the coupling efficiency, primary to secondary. This may change the true reflected load by a few percent but that is all. It is not the point that has been worrying our correspondent.

Precisely the same observation would be true if the secondaries were taken of and rewound with the wires laid side by side. Or yet again, if the space thus made available was occupied by the same number of turns of a much heavier gauge.

The nominal impedance would remain at 500 ohms and only the efficiency would be changed.

Funny how consistent "theory" is, sometimes!

BEAT FREQUENCY OSCILLATORS

In the past fortnight we have had some pretty heated arguments up here on the subject of beat frequency oscillators. This is one of those cases where theory apparently contradicts practice. The "practice" here is provided by an ATR4A receiver which we use for the Met. reports and the "theory" is provided by ourselves.

It looks as if we will have little use for either shortly, as the argument can only terminate in manslaughter at least.

It's like this: When a receiver fitted with a BFO is tuned across an unmodulated signal, the BFO note gradually descends the scale to zero, then rises again on the other side of the signal.

This has us baffled and perplexed. We can quite understand the case of a TRF where, in effect, the BFO varies in frequency as the receiver is tuned. But, the superhet . . . or dear no! As far as we can see, the BFO note should vary in amplitude, not frequency, because the signal in the IF channel is fixed and so also is the BFO frequency, unless it is deliberately altered. Maximum amplitude of the beat note would correspond with resonance.

Take the case of a 455Kc superhet . . . &c.

One of the chaps here, who was a Sigs, sergeant in the war suggested that the variation in beat note was due to sidebands in the IF. But where would the sidebands come from when CW only is being transmitted?

I simply can't understand it. Nor can anyone else. (E.S. North Queensland).

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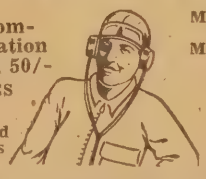

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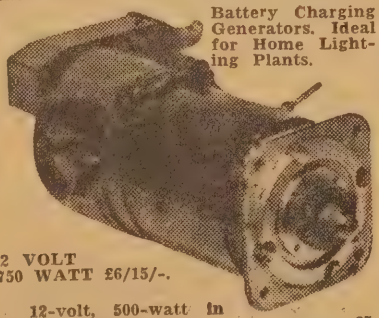

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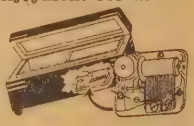

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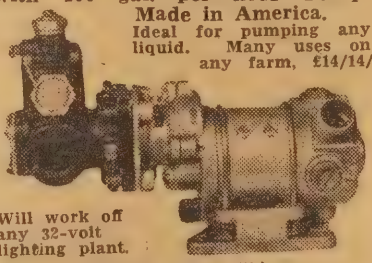

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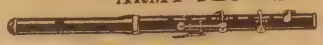

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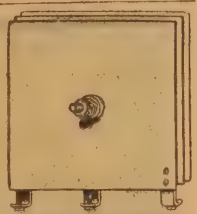

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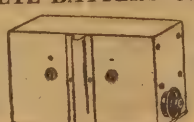

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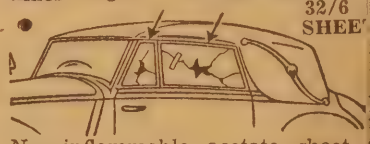

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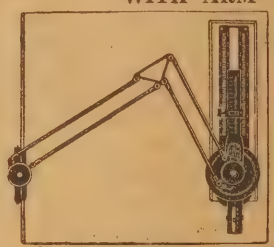

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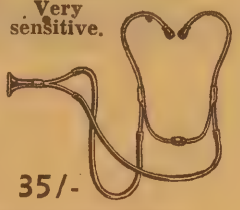

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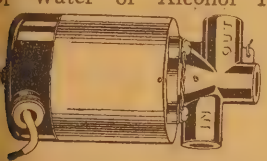

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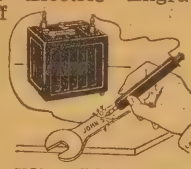

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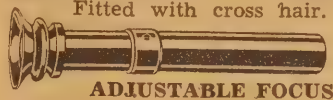

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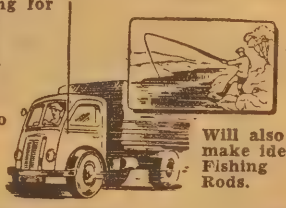

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OFF THE RECORD — NEWS & REVIEWS

Albert Schweitzer is one of our great world citizens—an intellectual paradox to anyone not familiar with his stature and dedication to his fellow men. Despite his learning, and his gifts as a musician, much of his life is spent on a mission station in Equatorial Africa, and most of his private means devoted to its upkeep. Occasionally he returns to Europe to play the organ and to study.

By JOHN MOYLE

HE has university degrees in medicine, philosophy and probably in other subjects as well. He was professor of theology at Strasbourg, and is a world authority on the organ music of Bach.

He is, in fact, the most famous Bach exponent of today, despite his 80 years and self imposed exile from musical centres. That is not as big a handicap as it might be, for Schweitzer's stature as a musician is largely intellectual. Without his own personal experiences and broad humanity he would not be the master he is.

His appreciation of Bach and his approach to the music is set out in his books on the subject, in which the reader can learn as much about both performer and composer as he can by listening.

Fortunately Schweitzer has made many records. Before the war his Bach Society recordings were treasured by their owners, and others which found their way into the catalogues captured a great deal of the mighty music he played.

Now Columbia is issuing a number of Schweitzer LP records which are quite the best examples we are likely to hear. The first is now due for release.

BACH — Toccata, Adagio and Fugue in C Major, Fugue in A Minor, Fantasia and Fugue in G Minor. Played by Albert Schweitzer, organ. Columbia 33CX 1074.

These I believe were recorded in the Parish Church of Gunsback, Alsace, although the record jacket does not tell us so. There will be many opinions about which are Bach's finest organ pieces, but few will quarrel with a grouping such as this. To anyone who wishes to seek and understand the real stature of Bach, I could not recommend any other music more highly. All I could do would be to wish one record could contain twice as much.

And to any who have shied away from that maligned word "fugue" I equally commend it. It is quite impossible to remain unmoved by these monumental structures of music and sound.

Schweitzer's approach is a long way from the Stokowski conception, the Walt Disney showmanship, or any other ideas of pepping up Bach. If you haven't heard works like these played with authentic organ registration, then you really haven't heard them at all.

At the same time, it is impossible to hear this record without remembering the man who is playing the music. Other great organists may play these things more impressively as pure sound, other organs will give them different coloring and weight. But you will never hear more sincere and almost reverent handling of these masterpieces which represent the foundations of great music.

Is there any trace of Schweitzer's years to be heard? I think there is. His playing was formerly more massive, more vigorous, less ponderous. There is some uncertainty at times where his fingers are slow, but they leave no more impression than did the odd handful of wrong notes which Schnabel occasionally gave us. Like Schnabel, we are hearing the mind of a man as well as the music, and the former is strong enough to take such things in its stride. There is something in this organ playing we are not likely to hear again.

The organ tone is most impressive. It is spacious and strong with no sign of oppression. Schweitzer's tempos are slow and firm, and that fact alone results in a fine resolution of notes and of registration. Microphone placing, as I know from personal experience, is extremely difficult in organ recordings, but I am happy with this result. One notes a number of obvious tape joins, not because the music is disconnected but because each fresh start is made with an inevitable break in reverberation. I don't see how it can be avoided.

I believe this to be a most important record of organ music and would pick it for the reasons I have given as the record of the month.

BEETHOVEN — Piano Concert No. 5 in E Flat Major (Emperor) played by Cor De Groot and the Residency Orchestra (The Hague) conducted by William van Otterloo Philips A 00133 L.

By and large this is a most attractive version of the Emperor, and it contains some very distinguished playing. I liked it for its vitality and clear musical outline, even if I didn't always agree with the pianist.

For instance, he has a tendency to romanticise where I feel romantic are unnecessary, something which I feel is constitutional with him. He works sometimes on tempo without to my mind, placing his underlining in the right places. But he certainly knows what he is doing and proceeds to do it with authority and decision.

The orchestra is with him all the way, although there is a somewhat excessive reverberation which tends to produce a wooliness where I would like to have heard the instruments more individually. In the first movement the piano is somewhat overpowered, but the second and third were played with a much better balance.

Microphone placing is rather remote, but not excessively so—the effect is definitely concert hall rather than recording studio. That really sums up most of my impressions about balance and general tone.

Not wide range, but should be easy to play on almost anything.

BRAHMS — Fantasien Nos. 1- Played by Carl Sleemann (piano) Deutsche Grammophon 16032LP.

Not everybody can play Brahms well, and these later piano pieces are a test for a fine pianist. Without an understanding of Brahms and the emergent qualities of the music, so much can be meaningless. But Sleemann is a superb Brahms exponent.

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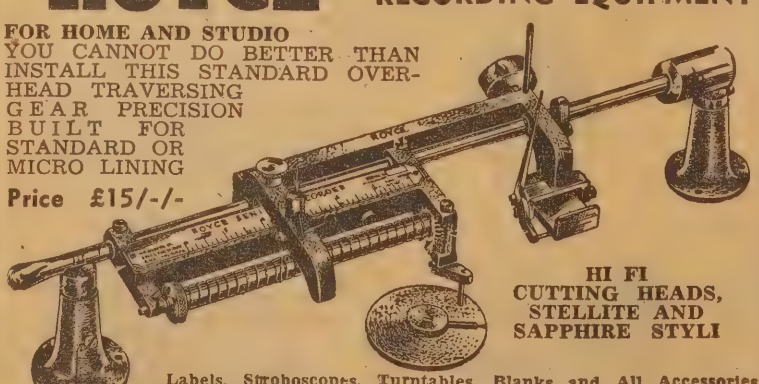

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ert hall rather than in a studio. At mes the upper register is somewhat ispersed, and the bass register a ttle dull. But these are minor mat- rs against an overall beauty of re- orded tone which is quite outstand- g.

Technically the disc is impeccable, id as fine an example of modern ressing as one could wish. Sur- ce noise is completely absent and ere is no suggestion at any time of distorted or dirty note. If you'd ke to know how good a piano can und on a record today, this is it.

LISZT — Les Preludes, Hungaria, ayed by the Berlin Philharmonic id the Bamberg Symphony Orches- as conducted by Leopold Ludwig id Ferdinand Leitner. Deutsche rammophon 16044LP.

Two performances which might ell have been made in the same udio — crystal clear in their out- nes but sounding a little small in ze. The brass is extremely good, e smaller parts well balanced and ere isn't a sour note. The surface almost irreproachable and much ove average. The playing isn't owy, but sound and well shaped. oth sides are clean to the end.

GLUCK — Dance of the Furies om "Orpheus" — MOZART — Within these Temple Walls." Played the Munchener Philharmonica ith Kim Borg (Bass) Deutsche rammophon 30011B. DER SCH- AGE OTTO — Honk-tonk piano id drums, Popular numbers. Poly- r 22009A.

Superbly recorded 45's at opposite ds of the scale. Kim Borg has a agnificent voice and this record- g is equal to any I have ever heard. 's a pity he doesn't star on both des, although the Furies shows oquently what the orchestra can . Sur ace noise is completely sent. The ragtime is a gem in its ay — a light-hearted interlude to ow what real wide-range can be ke. I can recommend them both.

RAVEL — Bolero. BORODIN — ances from Prince Igor. Played by e Chorus and Orchestra of Radio erlin. Nixa-Urania UREP 57 and .

These are two extended-play 45's. oth are performed with vigor and eight. The climax of Bolero is proached with characteristic, mad- ning inevitability and a nicely re- rded orchestral build-up — a really od performance. Prince Igor is milarly well done. Surfaces are ir but inaudible behind the wall of und.

SCHUBERT—Four Impromptus, pus 142. Played by Clifford Curzon. ecca LXT2781.

There are some effective sections this record, but on the whole I ought Curzon too fiddly and mat- of fact to do justice to Schubert. would have preferred a little less te perfection if I could have ard more warmth and more sense musical shape and flow.

There is no doubt about the pian- 's keyboard control, precision and arity—they are fine. But, with- t the rest, Schubert isn't satisfy- g played this way.

Technically there is plenty to ad- re. The piano tone is convinc- g, and, as I have indicated, note- rfect. There are a couple of acked notes on the second side, t they are exceptions. The sur- ce is above average.

RACHMANINOFF—Concerto No. 2 in C Minor, Op. 18; Melodie in E Major Op. 3 No. 3; Prelude in B Minor Op. 32 No. 10. Played by Cor de Groot and the Residency Orchestra conducted by Willem van Otterloo. Philips A 00162 L.

A perfectly competent and careful performance, but without enough drive to make it really distinguished. Its colors are too pale, and this is far from being a pale work.

Rachmaninoff himself showed us how these colors can glow, although in the days of his classical performance the recording art was a mere shadow of what we have today. Cor de Groot and van Otterloo have made a very pretty effort, but have mostly missed the fire. The second movement has some beautifully graded moments, but comes perilously near to falling apart—or asleep —in several places.

At the same time, I don't know that there is a better record available at the moment.

The two solo pieces confirm one's judgment of the pianist's sensitivity and good tone, and frankly I liked them best.

HAYDN—Quartet in D Major Op. 64 No. 5 (The Lark) and Quartet in B flat Major, Op. 76 No. 4 (The Sunrise), played by the Budapest String Quartet. Columbia 33CX 1061.

I was disappointed with this record because I felt that it could have been much better. I don't suppose there are two more beautiful quartets in Haydn's long list, not for that matter are there many instrumentalists as good as or better than the Budapest.

But the recording is dull by modern standards, not to say heavy. Much of the finesse and all of the glitter is gone from the performance, which sounds periously near to being scratchy and quite unimpressive where it should be anything but.

The Lark I thought the better of the two, but the contrast between the performance as a whole and what can be done is too great for a high fidelity fan. It should sound quite OK on the average 'gram, but I couldn't pass it as top class.

MILHAUD—String Quartet (1912). TURINA—La Oracion del Torero, played by the WQXR Quartet. Nixa QLP4004.

This quartet will show you, if you need to be shown, that there is a great deal more than weird experimentalism associated with French music of the later 18 and early 1900s, and that Milhaud is one of its most important representatives. It must be admitted that one has cause to shudder at many of the sounds produced by those times, and the years that followed, and that much that was written will remain unintelligible to the average man.

But music like this should not be passed by, particularly when played with such sensitivity and intelligence. Milhaud of this period was undoubtedly influenced by Debussy, but his own imagination and color sense are individual enough. Moreover, he has a feeling for melody which never becomes subservient to his technique. This record, I feel, is good enough to be a standard addition to any representative library.

The recording is a good one, and although the studio has a little rever-

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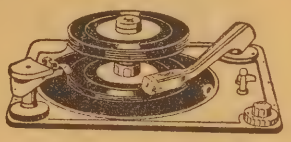

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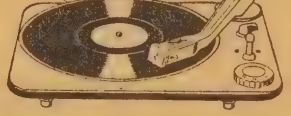

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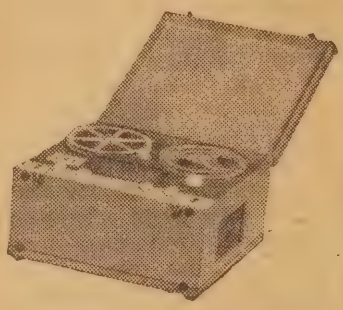

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beration, the effect is not out of place with such intimate music, and with such good instrumental balance. I'd have liked a little more resonance to the bass end, even with an NAB curve, but it isn't spoiled by the lack. The surface is well-nigh perfect which helps greatly to achieve an excellent presence. The quick ear will pick a few tape joins.

The Turina is long enough to make up the second side, but has little more than atmosphere and some further deft playing. It's as Spanish as Milhaud is French.

BRAHMS — Gesang Der Parzen, Nanie. RICHARD STRAUSS — Wanderer's Sturmleid. Orchestra by the Vienna Philharmonic, Choir by the Vienna Kammercho. Conducted by Henry Swoboda. Westminster WL5081.

An unusual record of choral music which will probably be as new to most of my readers as it was to me, for it is doubtful whether they have ever heard it, either on records or as a performance. The text of Nanie is by von Schiller, and the others by von Goethe, both of whom were the inspiration for a good deal of German music for voices.

I could not help being struck by the technical success of the record. One or two lapses in balance were probably due to the score as much as to the recording. Listening to such intelligent examples of part-writing makes one realise the impossible task Beethoven set his voices in the Ninth Symphony, which, after my recent spell of intensive listening to many versions, is still a live point with me!

If you are fond of choral work, there is much beautiful music on this disc, particularly from Strauss, and there has rarely been a better recording of its type.

BEETHOVEN — Octet in E Flat Major for 2 Oboes, Clarinets, Bassoons and Horns, Opus 103. Sextet in E Flat Major for 2 Clarinets, Bassoons and Horns, Opus 71. Played by the Vienna Philharmonic Wind Group. Westminster WL5003.

Another unusual record from Westminster shows a fine group of players to advantage. These are both early works, despite their opus numbers, and throw a most interesting light on Beethoven's early period. The Octet sounds the more mature work, which isn't surprising when we are told that the Sextet was written in a single night. The latter is much the simpler in treatment, and the material is often restricted to a small and somewhat obvious progression of notes.

While the musical content may not equal the stature of other Beethoven compositions, it does present an unrivalled example of wind instrument color, and skilful if experimental use of it. As pointed out on the record jacket, the frequent and prophetic allusions to Scherzo of the Ninth Symphony in the Octet are quite remarkable.

The recording is naturally more remote than Westminster's smaller chamber groups, but the balance and one of the instruments are handled as skilfully by the engineers as they are by the composer. The surface is little below the best, but still very quiet.

DVORAK—Symphony No. 5 in E Minor, Opus 95. Played by the Vienna Symphony Orchestra, conducted by Jascha Horenstein. Festival-Vox XTV17222.

Technically, this is one of Vox's best efforts. It is a particularly clean player, and even wide-range enthusiasts need have no fear of doubtful quality, even at the end of each side. Without being brilliant, it has good frequency range and excellent dynamic range.

The playing, too, is of a high standard, as we expect from the Vienna Orchestra.

On the debit side, I thought the conductor has worked over the music a little more than is necessary. This is a happy symphony which can be allowed to play itself to a large extent. By a slowish tempo and exposure of inner parts, I thought he bared the bones a bit.

This effect is heightened by what sounds like some microphone-chasing on the solos. The balance heard by the conductor generally bears little relationship to that heard by the microphone. A little more remoteness and less virtuosity would have held the musical body more together.

It's a fine record, for all that, and one likely to grow upon you.

TCHAIKOWSKY — Symphony No. 4 in F Minor. Played by the Vienna State Opera Orchestra, conducted by Hermann Scherchen. Westminster, WL5096.

If you like your Tchaikowsky "flat to the boards" then you'll like this record. If not—no. I doubt whether I have heard a disc which crammed so much sheer weight into two sides. Scherchen, apart from a few moments of restraint, curious by contrast, makes a really boisterous work of this—and, after all, perhaps it's not altogether out of place.

But I thought the effect would have been better if the recording hadn't been so forward. One could almost take a walk through the orchestra, so careful have the microphones been placed to bring everything into view. If their setting had been somewhat more remote, I wouldn't have felt so eager to run for cover!

Technically it is bright, with plenty of cymbal crashes to tickle your tweeters. I found it too sharp for AES, and even with NAB there is a touch of roughness to the top end which I doubt is due to pressing. One couldn't hear surface noise through the racket, even if it had been there. A slight tape hum in the second movement was a surprise.

Altogether a ripsnorter, but best suited to strong constitutions.

(Continued on Page 108)

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RECORD NEWS FROM ABROAD

After a delay which has been much longer than most record-buyers had expected, Philips have at last commenced the release in England of the American Columbia catalogue. The first list is in many ways a curious one and does not seem to have been chosen with an eye to capturing the immediate market.

By DISCOBOLUS

AT the head of the list, which is quite small, is a recording of the Berlioz "Te Deum", with the Royal Philharmonic Orchestra and Choir under Sir Thomas Beecham. As far as is known, Beecham is under contract to American Columbia and not EMI, and any new recordings made by him may be expected to appear outside America on the Philips label. This particular disc has not yet appeared in any of the American catalogues.

The next few have, however, but with different couplings. For instance, the Budapest String Quartet feature in Ravel's Quartet in F Major on a 10in Philips. In USA, it was coupled with Debussy's Quartet in G Minor on a 12in. Saint-Saens' "Carnival of Animals" is also on a 10in Philips, but in USA it was on a 12in Columbia, with Ravel's "Mother Goose Suite" on the reverse. This performance is by Kostelanetz, with Noel Coward doing the narration.

The rest of the Philips releases include choruses from operas by Verdi (a Dutch recording), the Ballet Music from Gounod's Faust, four Strauss Waltzes, the Sacred Pontifical Liturgy of the Russian Orthodox Church, Richard Strauss' "Salome", and a 10in LP made from Johnnie Ray's London Palladium act during his English visit of a year or so ago. The Benny Goodman Concert has also been issued, along with a number of others from the Dutch catalogue, which have already been released in Australia — so it may be that English LP's by Philips will give little indication of what to expect in Australia a few months later.

STRANGE CHOICE

With such a large repertoire at their disposal, it is difficult to see just why Philips picked on this selection as their introduction to the English LP field.

Reverting to the July releases for the other companies, HMV have the the 1953 Glyndebourne Production of Rossini's "Cinderella", and a complete "Vida Breve", by Falla, with Victoria de los Angeles. On the orchestral side, Toscanini conducts the Beethoven Symphonies Nos. 2 and 4, on a single 12in disc, while Cantelli and the Philharmonic Orchestra play the Brahms 1st. This month, Sir Adrian Boult is on both HMV and Decca, with the Elgar Wand of Youth and Enigma Variations for HMV and Rachmaninov's Rhapsody on a Theme of Paganini for Decca, featuring Julius Katchen who plays Dohnanyi's Variations on a Nursery Song.

The LP of the Mendelssohn "Scotch" Symphony by the Sydney Symphony Orchestra is on sale, but reviewers appear to favor the VOX release by Klemperer and the Vienna Symphony.

On Columbia, Malcuzynski is the soloist with the Philharmonia Orchestra and Paul Kletzki for Rachmaninov's Piano Concerto No. 3, and the same orchestra and conductor play Tchaikovsky's Serenade in C and the Bartered Bride Overture by Smetana. From French orchestras come some Bizet and symphonic poems by Saint-Saens.

Decca's main item is the Planets, by Holst, with Sir Malcolm Sargent and the London Symphony. In the past, Decca have followed EMI's footsteps very closely in copying the major releases, and now they seem destined to follow Philips — the latest is a Decca performance of Richard Strauss' "Salome", with the Vienna Phil. and Clemens Krauss.

78's TO DISAPPEAR

NIXA are adding records from the American label (mainly Urania and Westminster) at the rate of a dozen or so each month, but most of these have already been seen in Australia and cannot be classed as "news".

Some interesting changes are at present taking place in English 78 rpm circles, and the Australian market will be directly affected by an EMI decision to delete from the catalogues next January several thousand 78 rpm discs. If the vocal list is any guide, then the only 78's left in the catalogue will be the old warhorses of the sort featured in Commercial Radio's "classical" programs.

The whole of the Archive Series, the Society issues, and the Parlophone-CETRA series are among those to disappear. No doubt the really historic recordings will become available as Recital records on 45 or LP — and the main bugbear for collectors will then be to decide whether or not the new speeds cope adequately with "pitch", as it is a well-known fact that the early recordings were made at all sorts of speeds, 78 rpm being more of a co-incidence then than an intention. Serious collectors who have favored a motor capable of giving anything from 70 to 90 rpm for the old records will find it very difficult to obtain a motor to give a similar variation about 45 or 33 rpm.

I was surprised to read recently that Decca have taken over the Italian "Durium" catalogue, which consists of 78 rpm discs only, most of them in the light cabaret-style items. After Decca's pioneering in LP this is very strange. There is still no sign of Decca's excursion into 45 rpm discs, and these are evidently designed only for the USA market as far as Decca are concerned. However, they now have English representation for one of the French companies selling 7in 33 rpm discs, and they may introduce these at a later date.

WHAT MAKES A GOOD STUDIO?

Most of us who listen to recordings realise that some of them "sound" much better than others. I use the word in a special sense which refers more to acoustics than to music. In fact many very fine musical performances are quite spoiled by something just not right with the studio or recording hall. And yet some comparatively trifling popular numbers come through with breathtaking realism.

T isn't hard to trace a connection between results and the recording tudio or hall. It's only a step further to realise that the microphone placement in either can make a big difference and, of course, the grouping of instruments near the microphone. An obvious question to follow would be—"If one is good, why an't all be good?" If it comes to hat, we can legitimately ask, 'What's wrong with the bad ones, nyhow?"

In order to supply suitable answers, sound engineers have spent nuch thought—and money!—analying what goes on in recording tudios, and finding out what can be lone to them to make the discs sound he way they should.

CONVINCING—REALISTIC

I will neatly skip around that hrase "the way they should", by urning my back for the time being n the old argument about whether he recordings should "bring performance into your home". I'll substitute a simple answer, that the nusic should sound convincing and ealistic, so that the effect is satisfying in relation to the music being ecorded.

For instance, a string quartet recorded from the rear of the Melbourne Town Hall wouldn't sound ery convincing. Neither does a large ymphony orchestra playing a fortissimo in a small, dead studio sound ealistic. Nor would a honky-tonk ecord be so hot if an essential string ass drowned out everything else, r, on the other hand, was inaudible.

These examples give a lead to some f the important things to be watched vhen arranging a recording set-up. They are balance, which means the ecording of all parts in reasonable roportion, one to the other, and the ontrol of echo or reverberation, vhich is perhaps the most important hing in getting everything to sound" or "speak" well.

ACOUSTICS

Let me expand in general terms a ttle further on these matters, beause they are vitally important vhen assessing whether a recording s acoustically good or bad. We night even leave out that word acoustically", for bad acoustics can o often completely ruin all sense of nusical values.

We should first of all remember, s I have pointed out more than nce, that the ear of the microphone n't at all like our own ears. We an set up an orchestra in a hall for concert and it sounds fine, but hen we use the microphone it may ound horrible. That is perhaps the rst elementary lesson learned by ie engineers. Their ears can help iem very little and, in most cases, e definitely misleading.

There are several reasons for this. The main one is that the microphone is only one ear, whereas we have two. Each ear hears the sound quite differently.

In the first place the sound which reaches our ears is heard by them at two spots separated by the width of our head. Moreover, it doesn't travel along the same path to each ear.

If we are facing the source of sound, there isn't much difference in the actual path length of the direct sound, but the indirect sound, heard as echoes bouncing from the walls and all sorts of things in the room, is likely to be vastly different. The net result of this is that the binaural effect of two ears allows us to locate the sources of sound.

SINGLE POINT

A microphone shows none of this effect, and in any case the reproducing chain is a single point arrangement in the normal way, and even a combination of several microphones won't do anything to change it. They simply alter the sense of distance as between instruments near or further away.

Another effect of having two ears is that we can listen in a selective manner which allows us to reject quite noticeably sounds we don't want to hear. You can easily test for this by blocking up one ear, and noting how extraneous background noises intrude themselves where, with two ears, they are not nearly so obvious. Echoes become particularly annoying, and if not controlled can create an almost intolerable effect of confusion. Normally we call the echo effect reverberation, and its control is perhaps the most important single problem.

In the early days of broadcasting, and of recording, the technique was

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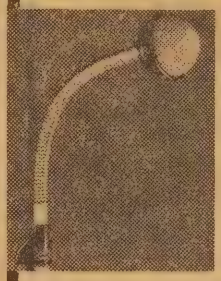

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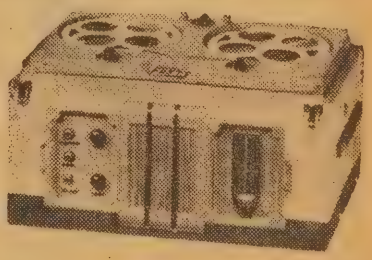

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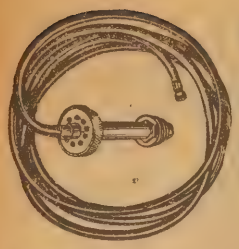

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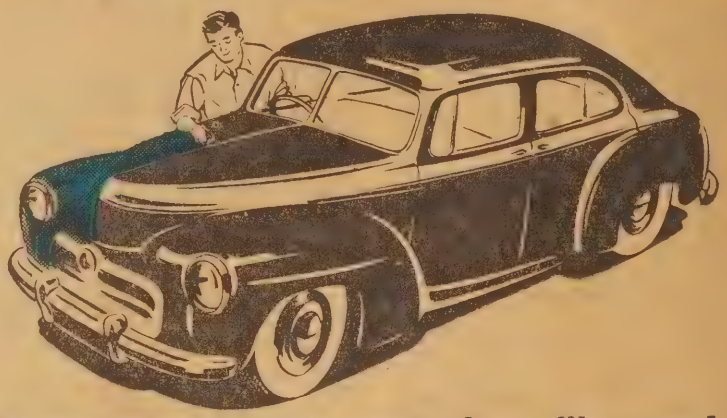

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reduce or eliminate reverberation draping studios with heavy curns, or lining the walls with terial which had a very heavy e of sound absorption. It also lped to keep down outside noises, rticularly as all kinds of buildings d to be used for studios.

This procedure was most effective killing reverberation, but it also led almost everything else about e sound. Sound which is absorbed ost forever, and these dead studios re very trying to use. The music erally died in the air, and singers mplained that they couldn't hear emselves sing.

Quite literally, that was happening. singer doesn't hear himself purely the direct sound he makes in his ad, but largely by the reflected nd from the studio. If you are a dding operatic tenor you will ow how easily you can sound like ruso in the bathroom, and how inequate your voice sounds in the en air.

ATHROOM SINGERS

In the bathroom, you set up reverration from bare walls, a resonant th or shower screen, &c., and ce your resonant notes have been nded, it takes little energy to ep the vibrations alive.

Outside, or in a dead studio, you ve to work much harder for your oney, and there are no reflected ves to build up your output.

For talks and recorded speech, the ect isn't at all bad, because here have a close-speaking technique which reverberation isn't really sirable. The voice would still be onant, but intelligibility would fer because of the need to underand quickly changing phrases and lections. Even a solo violin might ss, but it could never sound as ough it were in a concert hall.

So here we have something to work . Killing reverberation does not prove realism except perhaps for se speaking. On the contrary, conlled reverberation not only gives e to sound but makes the best use the sound power available. A ger does not have to shout or wd the microphone to be heard.

A little more about reverberation fore talking about the modern apoach.

ECHOES

If you think about it, you will alise that echoes are merely sound ves which bounce around the om, around the walls, from floor to ling, from corner to corner, and an almost infinite variety of paths. The strongest are those which can a half-wavelength of sound, or a mber of them, into the paths traved from the sound source to the r.

If we can imagine an exactly bical room, we will find many ths which have the same length om start to finish because of the om's symmetry and, consequently, usical notes which fit into this ngth in terms of half-wavelengths ll sound louder, or more resonant, an others.

You can easily find these notes for urself in the bathroom. When you ike "resonance" you can almost el the waves bouncing around the om.

Such resonances are out of place a studio, because they introduce mps or peaks in the sound which are not only objectionable, but spoil the balance of the performance.

They can be dealt with in two ways.

The first would be to introduce into the walls material which is highly sound-absorbent at these peak frequencies.

This might be necessary if the studio can't be wrecked and must be used, but it is only half the story in selecting the ideal recording chamber.

The other method is to select the ratio of length, width and height of the studio so that resonance peaks do not group themselves at one point, or even at a few points, but at so many that they are distributed evenly over the musical scale. This isn't hard to do by calculation, but we won't bother about figures right here. It's enough to say that this method alone will effect a big improvement in achieving a reverberation which is fairly well distributed over the sound range.

The response of the room can be made still more even by avoiding flat surfaces opposing each other, so that the sound waves in their journey around it are broken up and dispersed as soon as possible.

An effective approach to it is to build all large surfaces at odd angles to each other, and not parallel. Nearly every modern auditorium is made this way.

MODERN STUDIOS

Modern broadcasting studios go further, and line the walls and ceilings with semi-circular or angled sections. Semi-circular sections will disperse reflected sound in all directions, and angled sections in more than one. The result can be to kill any tendency for reflections to favor any one frequency or combination of frequencies by preventing the sound waves from getting started.

Such a studio will be realistically alive, but with virtually no sense of sound direction. One such, used by station 2UE in Sydney, is so good that it is almost impossible to locate the source of a sound merely by listening.

This, however, may not yet be the full story. We may have smoothed out the reverberation, but it may still be heard for too long a period. We can arrange to shorten its time constant by including wall and/or ceiling sections made of sound-absorbing material.

In fact, we have arrived now at the stage when we can control the studio's acoustics within quite reasonable limits. By selecting the right materials we can adjust the reverberation time to have a slow, even decay, or we can make it rapid at first with a longer tail-off. We can make it more effective at some frequencies than at others. Altogether, we have progressed a long way from merely taking what we can get and hanging up curtains!

Unfortunately, recording engineers are not yet able to make wide use of idealised studios such as have been described, simply because they are not widely available. One or two built on modern principles have been erected, notably the Festival Hall in England. This hall included every idea of controlled acoustics current

(Continued on Page 103)

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SHORT-WAVE NOTES BY ART CUSHEN

SOUTH AMERICAN LF STATIONS VERY STRONG

Listeners in Australasia will look back to the winter of 1954 as one of the best for reception of low frequency South American stations, as both broadcast band and short-wave stations have been received at strengths unsurpassed in the field of DX from that area. In particular, 49 and 60 metre signals in the afternoons have provided many new stations.

IN the late evening, signals in New Zealand, and to a lesser extent in Australia have given further chances for transmission reports to be submitted to these many interesting low powered stations.

CP5 "Radio Illimani, La Voz de Bolivia" at La Paz, now operating on 5955Kc closes at 2.02 pm with a Latin American number, signals being fairly strong, but with side interference from HJCF (5960) "La Voz de Bogota" Bogota, Colombia, which also closes at that time. CP5 has been also heard at 9.30 pm, at which time HJCF is also operating.

ZYN6, Fortaleza, Brazil, operated by the Ceara Radio Club, was heard during June at noon, a very early hour for signals from South America. ZYN6 operates on 6105Kc and suffered side interference from GSL (6110) and ZYB7 (6095).

PRA8, Recife, which is operated by the Radio Club of Pernambuco provides good signals on 6015Kc to as late as 12.30 pm, when the program consisted of popular recorded American music.

ZYR61, Tuabate, Sao Paulo, using 4855Kc to sign off at 1.00 pm, ZYR61 uses the slogan "Radiodifusora Tuabate."

PRF6, Manuas, located at the headwaters of the Amazon, operates on 4895Kc and has been heard consistently at 1 pm, along with ZYS8 (4805) located in the same city. ZYS8 also provides good signals when opening at 8 pm.

ZPA5 "Radio Encarnacion", Encarnacion, Paraguay, is the most constant station in this country and provides good signals in the mornings on 11950Kc. At 8 am a news broadcast relayed from "Radio Belgrano" Buenos Aires, Argentina, is carried, which might lead to some confusion as to the location of the station.

COLOMBIA

HJHC "Radio Narino" Pasto, one of the new Colombians has been heard on 4825Kc to sign off at 2.28 pm, with the Colombian National Anthem. Spanish announcements at 2.00 pm indicate a news broadcast in progress, while the closing announcements indicate the station is a member of the RCN Network (Radio Cadena Nacional) one of the two main Colombian networks, the other being CAPACOL (Primera Cadena Radio Colombiana). HJHC's address is Apartado Aero 390, Pasto and they operate with 1000W.

HJDI "Radio Libertad" in Medellin, is a further new station being received at 1.00 pm on 5980Kc. Signals are faint at that hour when a news broadcast is carried, but from 1.15 pm jamming is severe when a BBC transmitter opens on 5975Kc. The station relays the broadcast band programs of HJDO (650Kc) and both stations are listed as 10Kw according to World Radio Handbook. These two stations have only recently begun operation, and as yet, no listener has reported a verification.

HC6BT, Ambato, using 4705Kc has been heard regularly to close at 1.58 pm with the Ecuadorian National Anthem. "La Voz del Tungarahua" is the station's slogan, and the power used is 250W.

HC2LB "Radio America" Guayaquil, is the easiest received Ecuadorian at present, as they operate to 4.00 pm each day on 4550Kc, power listed is 250W.

HC4FF, Esmaraldes, on 4705Kc closes at 2.30 pm, as does the Quito station HCIGP on 4790Kc.

Reception of every South American country has been possible during the afternoons, with the exception of the Guinea stations. Most listeners will have found the short-wave bands in the 49 and 60M area, in particular, as active as they have been for many years.

HCIAC," La Voz de Democracia" Quito, which now operates on 6065Kc opens at 9.00 pm, has news 9.20 pm, and has also been heard to 3.30 pm.

The American Armed Forces Korean Network, which for several years has been operating on broadcast band, has put a short-wave transmitter on the air, and is operating on 6895Kc. First reported by Graham Hutchins, of Melbourne, the station has been heard in NZ at strength from fair to good, but the morse interference on the frequency is severe.

Indentification is given as "American Forces Korean Network, this is Vagabond" has been heard at 9.00 pm, when the time is announced as 7.30 pm Korean Standard Time. The new time zone in South Korea, now known as Korean Standard Time, is 8½ hours ahead of GMT instead of 9 hours ahead of GMT, the time zone which has been in operation in both North and South Korea for several years.

AKFN programs are the usual AFKN transcribed shows, and the station appears to operate 24 hours a day, like the broadcast band stations it relays.

The broadcast band stations most of which have been verified by the writer use code names, and the key station is Vagabond located at Seoul. It seems that the short-wave station takes the programs of any of the broadcast band transmitters, and the names of the stations Troubador, Nomad, Gypsy, Kilroy, Hoinstead, Mercury, Rambler and Meteor may be heard as the station from which the AFKN broadcast is being relayed.

AFKN transmitters all use 1000W except Mercury and Meteor operating with 250W. The new short-wave transmitter of AFKN is reported by a Japanese listener to be using 400W. Reports should be sent to the Chief Engineer, American Forces Korean Network, AFKN Headquarters, 8214th Army Unit, Seoul, Korea.

Times used are Australian Eastern Standard Time. Notes for the next issue should be sent to Arthur Cushen, 212 Earn St., Invercargill, New Zealand.

FEN TOKIO TESTS

Test broadcasts from the Far East Network, Tokio, have been heard on 11750Kc from 7.00 pm to 8.30 pm daily. The program is not as carried on the usual FEN frequency of 11825Kc at this time. Frequent announcements are made to the effect that the broadcast is a special test from Tokio and reports are requested. The signal strength in New Zealand is very good when closing at 8.30 pm, strength building up throughout the transmission. The usual AFRS programs are presented, with "FEN Tokio" as the station identification. Reports are verified by a card from R. H. Phillips, Network Radio Engineer, APO 613, c/o Post Master, San Francisco.

FLASHES FROM EVERYWHERE

PHILIPPINES — DZ12, Manila, operating on 9550Kc, verifies a New Zealand reader, Merv Simpson, with the news that the details about the station in the latest issue of World Radio Handbook are not correct. DZ12 is operated by the Alto Broadcasting System, Fifth Floor, Republic Super Market Buildings, Manila, and not by the Bolinas Electric Corporation. The Alto Broadcasting System is actually a new organisation, which has now a network of six broadcast band stations, DZ12 and DZAQ-TV, Philippines' first TV station. Sign off is 1.0 am, and the station uses 400W and a half-wave antenna. DZ12's verification is signed by Harry T. Chaney, jun., vice-president, who states that International Reply Coupons with reports are appreciated, but not essential. The station would appreciate reports from any listeners in this area.

RADIO TAHITI'S verification from M. R. Bonnet, Chief of the Post and Telegraph Services, Papeete, states that the transmitter on 7025Kc uses only 200 watts. The station is very interested to receive reports from listeners, and states that the poor modulation we reported is due to the fact that the transmitter is intended for telephone work, and has been adapted for broadcasting in the Tahiti area. Modulation is shown as 85 pc. Signals are still being received from Papeete at 4.0 pm, on 7025Kc.

KENYA'S VQ7LO, located in Nairobi, has made a frequency change to avoid interference from a station which has prior claim to this former frequency of 4855Kc. The change was made on May 8th, reports ISWC, and the new frequency is now 4885Kc.

WRUL, BOSTON, has now reverted to private ownership, and the broadcasts of the World Wide Broadcasting Corporation, are now being received on its frequencies, 17750, 15530, 11780, 9581 with an English program at 9.0 am.

SARAWAK'S entry into the broadcasting field on June 7th, resulted in broadcasts being heard in Melbourne by Graham Hutchins, and the information released over Radio Australia. Located at Kuching, the new station operates on 850 and 4870Kc. The transmissions are from 8.30 to 11.45 pm, daily, and the programs consist of English, 8.30-9.30 pm; Iban, 9.30-10.0 pm; Chinese, 10.0-10.45 pm; Malay, 10.45-11.30 pm; English, 11.45 pm. Reception is difficult, due to rather severe side interference from an Indonesian station on 4855Kc. Broadcasts in Sarawak have been taking place from Jesselton for some time, but have never been reported over any distance. The frequency is 7237Kc, with a daily broadcast 2.0-3.0 pm. Power of this station is 250w.

OKINAWA'S Far East Network relay on 4090Kc, which we reported last month as being received in New Zealand at 9 am, is now being received at fair strength in South Australia, reports George Hughes, of Hilton. George hears the FEN transmitter best at 11 pm, with the usual Armed Forces Network program.

SINGAPORE, outlet of Radio Malaya has been logged by Rex Gillett, Hobart, S. Aust., on 4920Kc, when signals have been received at good strength at 10.0 pm, opening transmission on this frequency. Signals are also good on the 41M frequency 7200Kc, which operates at the same time. Rex Gillett is verifying Bagdad, Iraq, recently, bringing his score of countries verified to 92. We are certain that this is the highest number of countries verified by any Australian listener.

THE HAM BANDS WITH BILL MOORE

Radio amateurs in the United Kingdom now operate under new licence regulations and will enjoy far greater privileges than they experienced previously.

THE details of the rules covering new amateur radio licences as available Great Britain shows the liberal attitude the British GPO toward the hobby. me extremely interesting features are cluded in the three new classes. The riations over the previous regulations ing the British amateur on level terms ith his American counterpart enjoying milar privileges.

The three classes of licences now cur-nt are Amateur (Sound) Licence, an-ual fee of £2, Amateur (Sound Mobile) cence, fee £1, and Amateur (Television) cence, fee £2. These annual fees cover y power, and no additional charge is ade whether the licence power is 10 150 watts.

The regulations clarify a number of oints that have been the subject of ebate for a long period.

IMPLE STYLE

They have been re-written in a simple anner and amateurs in the United King-om in general and the National Society. e RSGB, are extremely happy with e new licence terms.

Various clauses in all classes of licences rovide interesting comparisons with cur-nt regulations in other countries. Some these are as follows:-

The clause covering frequency control d measurement permits the licensee to e his discretion as to the type of uipment used. Previously specific uipment was listed.

Transmissions may be recorded and played, a privilege available to all nateurs. The covering clause is as llows:-

Messages addressed to the station from y amateur station with which the ensee is in communication may be re-rded and retransmitted in accordance ith this licence, provided that the re-ansmission is intended for reception the originating station only, and that e call sign of that station is not in-uded in the retransmission.

The restricting of sending periods to minutes only has been removed.

A very definite advancement is the anting of permission for portable opera-n at any time away from home QTH. peration on any frequency is permitted om an alternative location for a period t exceeding four weeks, the suffix /A be used. If operation extends for period in excess of that period the O must be advised in writing.

Net operation is now officially accepted and group operation allowed. It was not officially permitted previously.

Amateurs too must take every reasonable precaution to ensure their transmissions do not interfere with other amateur stations.

The operator is no longer required to sign the log each time he operates, but must send his call sign on CW at a speed not in excess of 12 words per minute.

There is no limit at present on the distance stations may be located from government wireless stations.

A number of interpretations are also listed, and run in similar strain to those here in Australia.

The expression "remarks about matters of a personal nature", does not include messages about business affairs.

Nothing in the licence shall be deemed to authorise the use of the station for business, advertisement, or propaganda purposes, or for the sending of news or messages of or on behalf of, or for the benefit or information of any social, political, religious or commercial organisation, or anyone other than the licensee or the person with whom he is in communication.

A separate B/c licence is required for B/c reception, antenna mast heights are restricted close to aerodromes, and the contents of messages received must not be divulged to other than authorised persons.

The GPO may now publish the name and address of licensees unless especially requested not to do so. This now allows the publication of call sign books without having to obtain permission from amateurs to publish their call sign and QTH.

NEW MOBILE LICENCE

A completely new class of licence is the Sound Mobile Licence which allows operation from any vehicle, or from any vessel, provided the vessel is not on the sea, or within any estuary, dock or harbor. Stations will use the suffix /M and will open up a completely new field of operation for UK amateurs.

The amateur Television Licence has been well received and although the number of stations now operating is small, it is anticipated that these regulations will serve as a model for future rule-making in other countries.

The UK amateur now has a new and up-to-date charter, a considerable improvement on the old one. Generally these regulations are in line with those enjoyed by Australian amateurs for a number of years.

WIRELESS INSTITUTE NEWS

THE problem of conducting a correspondence AOCP course for country dio enthusiasts has been considered on any occasions through the years by e NSW Divisional Council. There al-ys seem to be the insurmountable oblem of finding an amateur with suf-ent spare time to draw up a com-ete course.

A compromise however will be ar-nged that should assist intending nateurs.

Associate members who are studying their AOCP or Limited AOCP will be le to have their answers to previous OCP examination questions checked and mmented upon by the AOCP class anager.

Lecturer at the June meeting of the SW Division of the WIA was Mr. bert K. MacCulloch, BE, an engineer STC who recently had been abroad udying television problems.

The lecturer reviewed television as saw it on the Continent, in America d in England, discussed likely develop-nts here in Australia, and possible costs of receivers. It was an extremely descriptive talk covering a wide field. It was the lecturer's opinion that with color television a "going concern" in the US due consideration should be given to the adoption of a similar system here.

The interest shown in the lecture was reflected by the varied questions directed to the lecturer.

To facilitate the effective relay of VK2WI's transmissions on other than 7mc/s from any QTH, the NSW Division have decided to ask the UHF section of that Division to construct a complete 144 mc station for simultaneous 144 mc operation from the originating station.

The UHF section originally submitted the design for the equipment and the link will allow the most effective use of the 3.5 mc band.

BCI has always been a problem on the latter band around Sydney, and Allan Cole, VK2ACC, has again taken over the 3.5 mc band broadcast for the winter from his QTH, 20 miles south of Sydney. He obtains remarkable coverage at 11 am on this band S8 to S9 up to 300 miles and further.

REMEMBRANCE DAY CONTEST

THE Remembrance Day Contest is presented annually and is the best supported of these events run by the Wireless Institute of Australia.

It is conducted on the weekend nearest the anniversary of VP Day, August 15. It is held to perpetuate the memory of Australian radio amateurs who gave their lives for their country during World War II.

Their names and call signs are engraved on the trophy which is awarded annually to the Division of the WIA whose leading competitors compile the highest score.

Amateurs throughout the Commonwealth are especially invited to participate in the contest. The rules are as follows:-

1. The contest will commence at 1800 hours EAST on August 14 and continue through until 1759 hours on August 15.

2. The Contest is open to all Australian amateurs, but only members of the WIA are eligible for the awards.

3. The contest is an open event — C.W., phone or a combination of both may be used.

4. The contest is an interstate contest and amateurs in each State will endeavor to contact amateurs in all other States.

5. A station may be operated by more than one operator under the station call sign provided that operators other than the station licensee submit a separate log under his own call sign for contest purposes.

6. All existing amateur bands may be used and all transmissions must conform with the regulations as laid down in the PMG's Handbook for the Guidance of Operators of Amateur Wireless Stations. Any breaches of these will lead to the disqualification of the operator concerned.

7. The arrangement of schedules for contacts on other bands will not be permitted.

8. All stations entering the contest will call "CQ RD" if using CW, and "CQ Remembrance Day" if using phone.

9. A State competing for the trophy must submit a minimum of six (6) logs from financial members before becoming eligible for contesting the trophy.

10. Only one contact per station per band is permitted.

11. Serial numbers to be exchanged during the contest will be as follows:-

(a) For CW the first three figures will be the RST (Telegraphy) report, followed by the serial number of the contact commencing with any number between 001 and 100 for the first contact, and increasing in value by one (1) for each successful contact. If any contestant reaches 999 he will then commence 001 and continue 002, 003, 004, &c.

(b) For phone the first two figures will be the RS (Telephony) report, followed by the serial number of the contact commencing with any number between 001 and 100 and continuing as for CW contacts.

SERIAL NUMBERS

A complete exchange of serial numbers must take place before any points may be claimed for the contact.

12. In order that an equitable distribution of points for States with a large number of contestants compared with a State with fewer contestants may be determined, a sliding scale of points has been allotted as shown in the scoring table appended.

13. In addition to the points in the scoring table that may be scored by a contestant, a bonus of 25 points may be added to the total score for each State worked on 50 mc or above.

14. The log submitted must show in

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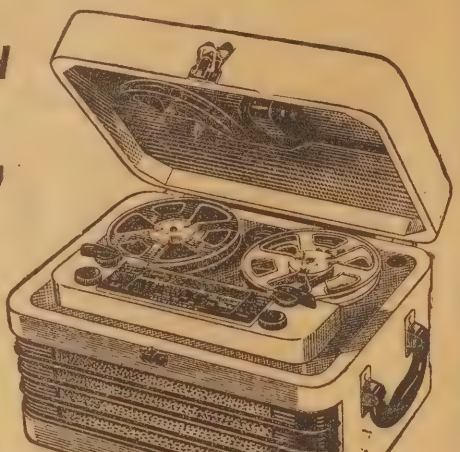


Price £112/15/-
Our deposit only **£15**

Use as 6-valve mantel radio AND record straight from it with magic-eye tuning and full range of controls. This marvellous "Minicorda" is really portable, only 23lb. Extra 600ft reels, cost only 45/-. Separate leather cover available.

OUR BEST SELLER

GRUNDIG

"REPORTER" Tape Recorder with Press-button control

Price 150 guineas
Our deposit only **£25**

This beautifully-finished, amazingly efficient model, The World's Finest Tape Recorder, has introduced a new world of entertainment to Australia. 50-10,000 c.p.s., 2 speeds, 2 track, condenser microphone.

ALL THE OTHER STAR PERFORMERS HERE, TOO

"Tecnicorda" Movie Tape Recorder, deposit **£18**

Synchronises with any 16, 8 or 9.5 mm. projector for real home talkies. 2 hours, 2 speeds. PRICE £139.

New "ELCON" Tape Recorder, deposit **£18**

Smart new plastic finish, tape indicator dial, 2 hours, 2 tracks, 2 speeds. £129/10/-. Radiocorder £154/10/-.

Magnetic Sound

Industries (AUST.), SYDNEY

385 GEORGE ST. OPPOSITE STRAND ARCADE

TAKE LIFT TO LOWER GROUND FLOOR SHOWROOM.

OPEN SATURDAY MORNINGS 9-12 • PHONE BX4440

"On Tape"

• Latest release this week is the Minicorda, a sparkling new Radio-Recorder. It's a super little 6-valve plus magic-eye Tape recorder and radio built into one compact case, attractively styled in green or fawn. Complete with microphone and aerial, the whole lot weighs only 23lb. Technically the tape recorder is very sound, using one motor for all functions — fast forward, rewind, etc. The amplifier is very cunningly planned with a minimum of components to reduce weight and wired neatly into a first-class job. Yet the price is only £112/15/- including sales tax (carrying cover available). Congratulations to its designer for producing a unit to suit everyone's needs at a sensible price.

• £8 DEPOSIT secures the "Elmec" de luxe deck, ready-made and tested. 9½ x 15in, twin track heads, 50-10,000 c.p.s., 2 speeds, 2 motors, fast forward and rewind. Costs only £43/10/-. Note also — 2-speed Flywheel, 79/6; Pinch wheels, 10/6; Reel holders, 12/6; Elmec heads, 97/6. £34/10/- gives you a complete Kitset from Magnetic Sound, easy to assemble with screwdriver and pliers, all parts beautifully made — 2 twin track heads, 2 speed, oscillator coil, Hoover motor. Guaranteed.

We still have M.S.I. Oscillator Coils, including circuit for 17/6 and Tape Recorder Motors, English, 3/16in, 75/-.

• Stock up on TAPE, too!
B.A.S.F. (L.G.N.) 1200ft, 67/6.
German B.A.S.F. 1200ft, 72/6; 600ft, 45/-.
E.M.I. TAPE, 1200ft, 58/-.
Westinghouse, 1200ft, 72/6 600ft, 45/-.
Latest Scotch Tape at 70/-, 45/-.
Spools—plastic 7in, 10/-; 5in 8/6.

• Magnetic Sound still has a few reels of tape left from our special purchase. These are terrific value, only used once or twice. Mainly Scotch Boy, 1200ft, each 30/-.

• New accessories for the Grundig Tape Recorder are arriving early this month. Worthy of note is the Mixer Unit — 4 channel inputs, tone control, volume control — finished in the usual immaculate Grundig style. Hand control foot control, headphones, plugs tape and splicing tape are all in this shipment.

Peter Clark

"Nothing but Tape Recorders"

he following order: Date, time, band mission, call sign, RST/No sent, RST/No eceived, points claimed. No log will be ccepted unless laid out in this order.

15. A statement signed by the operator ust be attached at the conclusion of the g stating that the Regulations (Rule) and these Rules have been observed. ny logs departing from this form will utomatically be disqualified.

16. All logs must be forwarded through ie Contestant's Divisional Council (for iembership checking) to reach the 'ederal Contest Committee, Box 1234K, PO, Adelaide, on or before September 11, 954.

17. Attractive certificates will be award- d to the first, second, third highest in ach State; there will be no outright inner for Australia. Where a large umber of logs is received from any ne State, further certificates may be warded at the discretion of the Con- est Committee.

18. The State to which the Perpetual rophy will be awarded shall be de- ermined as follows:-

To the average of the top six (6) gs shall be added a bonus arrived t by multiplying this average by the atio of valid logs submitted by that tate to the total of amateur licensees n the Division at the time of the contest.

19. The logs which will be accepted or the multiplier under Rule 18 shall how at least five (5) contacts in the ontest.

20. The trophy shall be forwarded to he winning State in its container and will e held by that State for a period of 12 nonths when the winner for the suceed- ng year is determined.

21. The Federal Contest Committee shall e the sole adjudicators and their ruling vill be binding in the case of any dis- ute.

Scoring table:-

Contacts from VK1 to any State — 6 oints. Other States to VK1 — 6 points. Contacts from VK2 to VK3 — 1 point, to /K4 — 2 points, VK5 — 3 points. VK6 — 5, VK7 — 4, VK9 — 6.

VK3 to VK2 — 1, VK4 — 3, VK5 — 2, /K6 — 5, VK7 — 4, VK9 — 6.

VK4 to VK2 — 1, VK3 — 2, VK5 — 3, /K6 — 6, VK7 — 5, VK9 — 4.

VK5 to VK2 — 2, VK3 — 1, VK4 — 3, /K6 — 5, VK7 — 4, VK9 — 6.

VK6 to VK2 — 1, VK3 — 2, VK4 — 4, /K5 — 3, VK7 — 5, VK9 — 6.

VK7 to VK2 — 2, VK3 — 1, VK4 — 4, /K5 — 3, VK6 — 5, VK9 — 6.

VK9 to VK2 —1, VK3 — 2, VK4 — 3, /K5 — 4, VK6 — 5, VK7 — 6.

DX AND PERSONAL

MID-WINTER provided the unusual in 80 metre conditions with some ex- ellent DX in June and July. During he last few years little DX has been eard in the evenings on that band. Normally the summer static level of the Northern Hemisphere keeps stations in hose regions from operating but appar- ntly a number of stations this year de- ided to search for DX despite the QRN.

The W & VE stations active listed many ontacts. Of most interest was the ppearance of YV5DE Venezuela on CW round 1900 to 2000 EAST on a number f evenings his frequency 3510 Kc/s.

South Americans are very scarce on he 3.5 ms band and a number of Oceania tations added this continent to their 3.5 ontinent list.

Incidentally a special WAC certificate s available through the WIA for work xclusively on this band. Also appear- ng at the same period was HRIAL, londuras, RST 569, who was surprised o find the band open to both VK and ZL. le made many contacts. To add a little nore DX color, Doug ZKIBG, Cook sland and Chas VKIAC, Macquarie sland were also active.

The YV and HR's frequency were rather aturated at times, the most consistent W was Van, W7JC who ran an average f 559 for a number of hours from 1800 AST onward.

SILENT KEY

THE sudden passing on July 6 of Hal Austin, VK5AW, is recorded with leep regret.

Hal was a well-known South Australian mateur and in recent years as operator f official WIA station VK5WI his voice ecame familiar to amateurs throughout he Commonwealth. A past State Presi- lent and Federal Councillor, he was an rdent worker for the Institute. His con- ributions toward the well-being of the obby will be greatly missed.

Deepest sympathy is extended to his amily on their sad loss.

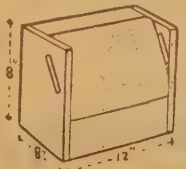
VIBROSCOPE ETCHING TOOL

An extremely efficient, new type etching tool. Combines mechanical vibration with electrical action. Indelibly marks ALL metals. Operates from Scope's Iron Transformer or AC/DC sources between 3 & 4 volts. Retail Price, 35/-.

Whether it is small, delicate work, or heavy duty jobs normally done with a 150 watt iron, you can't beat SCOPE for fast, efficient and economical soldering. This unique iron has all you could wish for . . . quick heating (only six seconds) . . . fast efficient soldering . . . automatic swich-off . . . low current consumption . . . and very little cleaning and tinning Scope operates from AC mains with National transformer optionally supplied, or from a battery. Test Scope yourself at your supplier.
Price 50/-. National Transformer, 47/11.

SCOPE INSTRUMENT BOX

Ideal for use in the construction of battery chargers, multimeters, VTVM's, oscillators, bridges, portable amplifiers, inter-com's. L.T. or H.T. power supplies and laboratory Instruments. Solidly constructed from sheetmetal, adequately ventilated, grey hammerstone finished. Used in the B.B.C. Price, 37/6, plus 12½% Sales Tax.



SCOPE INDUSTRIAL ELECTROPLATING UNIT

Guarantees fast, efficient and reliable plating, and offers many indisputable advantages to hundreds of industrial applications. This portable unit deposits nickel, copper, tin, zinc, cadium, silver, and gold on prepared metal surfaces where they stand. T.A.A. uses Scope for replating airscrews. Write or phone your supplier for full details. Price £23/18/- plus 12½% Sales Tax.

Australian & Overseas Agents:
WM. J. McLELLAN & CO. PTY. LTD.
126 Sussex St. (just North of King St.), Sydney. BX 1131.
MANUFACTURED BY SCOPE LABORATORIES, MELBOURNE, VICTORIA

DISTRIBUTORS IN ALL STATES.
N.Z. Distributor: H. W. Clarke, Auckland & Wellington.

RADIO TUNER UNIT

THIS TUNER IS RAPIDLY BECOMING STANDARD EQUIPMENT WITH TAPE AND AUDIO ENTHUSIASTS EVERYWHERE AND QUANTITY ORDERS HAVE ENABLED US TO REDUCE THE PRICE:

The unit is complete with valves (6AN7, 6N8), dial lamp, 4 pin input socket and plug. It has been wired, tested and aligned ready to connect to your amplifier or tape recorder.

SPECIFICATION—INPUT: 250 Volts 12mA. 6.3 Volts 0.7 Amps.

OUTPUT: Approx. 0.5 Volts across to 470 Kohms on local stations.

Price £11/14/6

Incl. S. Tax Freight Extra

REX *THE NEW NAME IN* **ELECTRONICS**

Coil Kit for R. & H. Mod. Osc. 29/6 incl. s.t. & postage

Dummy Antenna for Mod. Osc. £2/7/6 incl. s.t. & postage

Also Manufactured **(Quotations on Application)**

Quality custom-built Audio and Radio Equipment, Special Test Equipment, and all types of Receiver and Transmitter Coil Windings.

Rex Electronics

Box 4, P.O. Caringbah, N.S.W. MANUFACTURERS OF ELECTRONIC
Telephone LB6674 EQUIPMENT AND COMPONENTS

AFTER **STOCKTAKING BARGAINS**

EVERY ITEM BRAND NEW AND GUARANTEED

1.4 VOLT VALVES

1T4, 1R5, 1S5, 3S4 — 7/6 each

455 KC I.F. Transformers

Still a few available. Standard type permatune with square can.

2/-

OAK SWITCHES

A useful wafer switch:— Double pole double throw, plus a third on-off section.

1/6

STC 2 GANGS

Standard size condenser. Can be used in a crystal set, by disregarding one section.

7/6

PLAYMASTER No. 6 AMPLIFIER

Did you know that we can supply this remarkable amplifier, ready to use, from stock.
CALL AND HEAR ONE IN OPERATION.
Supplied complete with 12in Rola 12-0 or Jensen AU54 Speaker at the low price of —

£31/15/-

Please add postage to order. Any surplus will be refunded.

ROLA CHOKES 4 HENRY 60 MA

Size 1 7/8in x 1¼in x 1 3/8in high.

3/6

ROLA "C" SPEAKER Transformers

10,000 to 2 ohms.

3/6

MICA CONDENSERS

Manufacturers midget type. Sizes 50; 75; 100 and 150 mmF only.

2/6 doz.

PRICE'S RADIO

5-6 ANGEL PLACE, SYDNEY

YOUR AMATEUR TICKE

(Continued from Page 69)

the student at this stage, but larg sections are devoted to the explana tion of basic principles in a clea easy to understand, manner.

The book is normally availab in two volumes, but, unfortunatel volume 1 is out of print at th moment. Volume 2 is available approximately 25/-. We suggest th students will find it well wort while to try to borrow a copy volume 1 while they are studyin Copies of both volumes were obtain able from disposals sources.

OPERATOR'S NOTES

A similar publication is produce by the British Air Ministry unde the title of Electrical and Radi Notes for Wireless Operators. Muc of it appears to be along the sam lines as the Admiralty Handbook,.

It is readily available and th price is very reasonable, being ap proximately 9/6 a copy.

There are many textbooks i the higher price brackets, rangin from 70/- to 90/- or even highe but they mostly cover advanced ma terial and their high cost is hardl justified for a project of this kin Of course, if they are available o loan, it is often possible to mak good use of certain sections of them

Two exceptions appear to b Principles of Radio, by Henne and Understanding Radio, by Wat son, Welch and Eby. Both are read ily available at 59/- and 53/- respec tively.

RS6B HANDBOOK

Another book frequently recom mended is the Amateur Radi Handbook, published by the Radi Society of Great Britain. Unfortu nately it is no longer in print, bu it is well worth while canvassin your amateur friends for a loan o it while you're studying.

Also written specifically for th amateur is the Radio Handbook b Dawley. This was previously know as the "Jones" Handbook and wa regarded by many as one of th best in the matter of fundamental for the prospective ham. It is readil available at 59/-.

While on the subject of books w suggest you acquaint yourself wit the facilities available at your loca public library, this applying particu larly to those resident in or nea the capital cities.

USE LIBRARIES

Typical of these is Sydney's Mit chell Library in Macquarie St. has available, free of charge, vir tually every textbook or technica magazine (including Radio and Hob bies) ever published. Althoug books cannot be taken away, th facilities for study are excellent an a photostat service is available b means of which copies of particu larly valuable data may be obtain ed.

So there it is. We have trie to give you a clear picture of wha is involved without trying to mak it sound too hard or too easy. you want to get your ticket w will do your best to help.

But you must do the work!

WHAT MAKES A GOOD STUDIO

(Continued from Page 97)

at the time, and its characteristics can be adjusted to suit the performance.

Unfortunately, there are variables in the total result which can't always be foreseen. For instance, the presence of seats on the floor will alter appreciably the balance of reverberation and absorption, and there is a vast difference between a full and an empty hall.

But the Festival hall is famous for its conservation of sound, and the uniform distribution of it throughout the auditorium. Many conductors of orchestras don't like it, because they have been used to halls where the reverberation is wild and woolly. Naturally, their performances now sound completely different. The same is true of solo performers who can no longer rely on chamber resonances to build up their notes or—shall I say it?—to smooth over roughness or unevenness in production and technique.

DEADLY RECORDER

But this is the way we are treading in recording. The microphone is proving a deadly recorder, and nothing but perfection will do.

It is not surprising, therefore, remembering the great differences between halls used for recording, that the discs themselves should show it. In every city where recording and broadcasting takes place, engineers comb the streets for any kind of hall which, by the accident of their ancient or near ancient designers, happens to measure up to our modern ideas of a good auditorium. Some are good from the start, some can be made good by practicable treatment along the lines I have mentioned, and some are just plain hopeless.

The final answer is found in what comes off the monitoring tape when the final recording is made. After this, of course, we have to remember that recording engineers differ on how much reverberation they like to hear, how many microphones they think best, whether they will go for a "close-up" performance, and so on.

GLAMOR RECORDS

In this they may well be influenced by what the public likes and will buy. I often fear that the appeal of the "glamor" recording may prove a very strong influence on music generally, as it has done to some extent in the past. Records are made primarily to sell, and even musicians can't altogether be blamed for going along where the big money is.

Incidentally, the answer to the stunning recordings of many popular bands is that, being small, they can often play under carefully-controlled conditions in good studios small enough for recording companies or broadcasting stations to afford. And because such records sell in huge numbers and bring quick profits, there is everything to be gained by spending time and money on equipment and good bands. Using the same studio many times for similar works, the engineers soon learn to adopt standard techniques which have proved successful by experience.

BEAR TAPE
BRAND

Your storekeeper uses this width . . . so follow the lead of men and women who use tape most. And, in addition, "BEAR TAPE" seals tighter, mends better, and holds faster, because it's made here for Australian conditions.

"BEAR" ½" x 200" rolls, in gaily coloured plastic dispensers, cost only 1/9 each everywhere.

BEHR-MANNING, makers of the famous "BEAR TAPE," are also the largest manufacturers in the Southern Hemisphere of high-quality Sandpapers, Pressure-sensitive Tapes, Adhesives and Coatings, as well as being makers of "PROOFKOTE."

Y77C

MAKE EXTRA MONEY LIKE I DO

Full or part time. No kits or courses to buy. Guaranteed Money-Making Plans supplied. Free details from J. O'Rourke, Director, Profitable Enterprises (reg.), Dept. RH, Box 5070 GPO, Sydney.

ABUNDANCE

Learn how to use "thought-power" for your needs. Send 11d stamps for free 24-page "THOUGHT-CASTING" Booklets.

Benn, 24 Clarence Chambers, SOUTH GRAFTON, N.S.W.

TRANSONIC OUTPUT TRANSFORMERS

25 watt 30—16,000 c/s plus minus 1db 10000 PP to 15, 3.75 ohms. 115/6

12 watt 35—14,000 c/s plus minus 1db 10000 PP to 15, 8, 2 ohms 78/-

12 watt 35-14,000 c/s plus minus 1 db 8000 PP to 15, 8, 2 ohms. 78/-

Post Free Within Commonwealth.

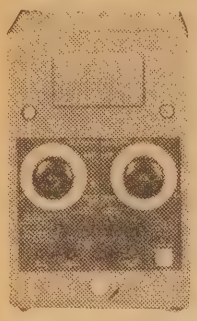
Other Impedances Available
Send S.A. Envelope for Quote.

TRANSONIC CO.

Box 30, P.O., Balgowlah, N.S.W.

A.R.8—COMMUNICATIONS—RECEIVERS

Converted for 240v. AC operation



Including power-supply, 9" x 7" ovaltone speaker

A.R.8 receivers are manufactured by A.W.A. and have a continuous coverage from 140 K.C. to 20 M'CS in six switched bands. Set contains 13 valves as follows: 3-6A8G, 4-6U7G, 2-6V6G, 1-6B8G, 1-6X5G, 1-6V4 and EM34 tuning indicator. Receiver, speaker and power supply are fitted in attractive and durable plastic-covered instrument case which makes this unit complete and portable. On/off switch and tone control are also fitted.

£34/17/6
F.O.R.

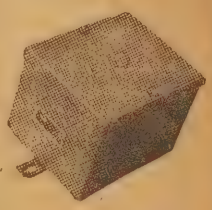
UNCONVERTED AR8

Supplied with valves (11) power supply lead and plug.
Air tested **£23/17/6 F.O.R.**

Supplied less valves and covers with power supply lead and plug. **£9/17/6 F.O.R.**

Supplied less valves, covers and dials. **£5/17/6 F.O.R.**

A.C. POWER-SUPPLY FOR AR8



240 volt A.C. power supply for use with any A.R.8 receiver. Supplied in brocaded finished case, with standard A.R.8 power supply plug fitted. Ready to plug into your receiver. Output 250v at 125MA. with 12 and 6v filament windings.

£7/17/6
F.O.R.

Circuit supplied free with all A.R.8 receivers

A.T.5 TRANSMITTERS

A.T.5 Transmitters supplied complete with valves (3-807 and 2-6V6), plug and circuit.
Price **£9/7/6**

A.T.5 Transmitter less valves.
With circuit **£5/5/-**

A.T.5 Transmitter less valves and covers.
With cricuit **£4/5/-**

HIGH-POWER I.R.C. RHEOSTATS

250 ohm, 25 watt.
10 ohm, 2½ amp; 25 ohm, 1 amp
Price, each **10/6**

CRYSTAL PICK-UP CARTRIDGES

Rothermel high fidelity pick-up cartridges, replacement for most pick-ups.

10/6 each.

BUTTERFLY CONDENSERS

Capacitance range 3-35 microfarad. Size 1¼ x 2¾ x 2¼ inches. brass plates: Ultra high frequency insulation: ¼ inch shaft.
Price, each **7/6**
Packing and postage: NSW, 1/-; Q., T. and V., 1/6; W.A., N.T., 2/-.

New A.W.A. VIBRATORS

6 or 12 volt A.W.A. gas filled vibrators, heavy duty, synchronous.
Price **15/-**
(Special price for quantity.)

D.C. GENERATORS

12V 750 watt. Ideal Home lighting, Battery charging, etc.
PRICE £4/10/- F.O.R.

TRICKLE-CHARGER KITS

Kits for trickle-charger as described in R. & H., June issue. Comprising transformer with 18V winding tapped at 12V-3 100mA rectifiers and 50 ohms control.
Postage: NSW, 5/-; Interstate, 7/6. **39/6**

1143A. TRANSCEIVERS

(English equivalent to SCR 522)
Frequency range 100 to 156 m/cs
Complete with 20 6.3V Valves.
New condition, supplied in transport case.

£12/12/- plus freight

SCR 522 GENEMOTORS

28 volt input D.C., regulated and filtered output filtered D.C. 300 volts at .26 amps; 150 volts at .01 amps; 14.5 volts at 5.0. Completely shielded in metal case, 12 x 8 x 5 inches.
Price, F.O.R. Each **55/-**

A.T.5-A.R.8 POWER SUPPLY

24 volt genemotors supply containing two genemotors, one giving 550 volt at 350 mills and the other 250 volt at 100 mills, also contains filter condensers, relays, fuse holders, etc.

£4/10/- **F.O.R.**

TYPE 1133 TRANSCEIVER

Freq. range 90 to 130 m/cs contains 17 6.3 volt valves.

£8/17/6

METROPOLITAN RADIO SUPPLIES

479 Parramatta Road, Leichhardt, N.S.W.
(at top of Taverner's Hill)
PHONE LM3610

TRANSFORMER SPECIAL

H.D. Power Transformer, 265 x 265 250mA 4v Fil. Windings .. £2/5/-
H.D. Power Transformer, 365 x 365 150mA 4v Fil. Windings .. £2/5/-
C.R.O. Transformer, -1540, 2V Filament Winding £2/5/-
150mA Filter Choke £1/2/6
Prices F.O.R.

NEW MN26 COMPASS CONTROL-BOX

37/6

23 pin plug for MN26 compass, 37/6.
18 pin plug for MN26 control box, 25/-.
6in Flexible drive for above, 10/-, 24in, 18/6.

Postage extra.

SPECIALS

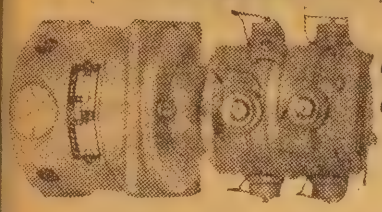
Bakelite Fuse Boxes	4/6
5-Position Push Button Switches,	12/6
Carbon Mike Trans	4/6
Double Button Carbon Mikes ..	7/6
Throat Mikes	5/-
Cutler Hammer Switches	2/6
Snielded Hook-up Wire, yard ..	8d
3 gang Standard Condenser	20/-
Twin Co-ax Cable, 20ft lengths ..	6/-
2 gang Condenser	16/-

NEW WESTON & FERRANTI METERS

0-.5 amp. RF thermocouple	9/6
0-3 amp. RF thermocouple	9/6
0-4 amp. RF thermocouple	9/6
0-10mA DC	17/6
0-20 volt DC	17/6
0-5 amp. DC	27/6
0-10 amp. DC	27/6

(All above are 2in-flush mount.)
0-10mA DC English Turner 3in Round Flush Mounting 30/-
Postage Extra.

SMALL 24-VOLT AC/DC MOTORS



29/6 PLUS POSTAGE

AMERICAN ANTENNA SWITCHING MOTORS

Complete with 8 Pye-Type Co-ax Bases, R.P.M. 1750, Ball Bearing.

AMERICAN REDMOND BLOWER MOTORS

Ball-bearing, fully laminated, 6000 R.P.M., 1 amp spindle 1¼ x ¼. Complete with blower, new in carton.

45/- PLUS POSTAGE

39/6 PLUS POSTAGE

Small 24v ball-bearing motor. Reversible, fully laminated, approx 1/15H.P.

Size 3¾" x 2½" with ¼" diameter shaft.

New Transformers Suitable For All Above Motors to Operate off 240v A.C. 30/- ea. plus postage.

Heavy Duty Genemotor

Suitable for conversion to A.C. motor (approx. one sixth H.P.) Fully laminated. Can be used as 6 or 12 volt generator at 20 or 13 amps £2/17/6 f.o.r.

NEW-AMERICAN TELEPHONE WIRE

Rubber insulation with stainless steel and copper conductors supplied on metal reels each containing half-mile of wire. £1/15/- per reel. Case lots, each containing six reels (three miles of wire). .. ..

£10 PER CASE F.O.R.

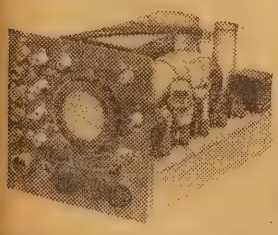
£1/-/-

Postage N.S.W. 4/6

Interstate 8/6

PORTABLE TEST SET

Containing 2½ inch 0-50 millimeter, six point key switch, &c., in case. (Used equipment.)



AMERICAN INDICATOR UNIT

These indicators are ideal for conversion to cathode ray oscilloscope having a built-in power supply, the power transformer only needs changing, and there is plenty of room for a time base tube etc. Supplied complete with the following valves:—
3BP with full length mu-metal shield, two 6SN7GT, two 6H6, one 2X2, one 6X5 and one 6G6G .. .. Freight extra **£8/17/6**

TRANSFORMER TO CONVERT THIS UNIT FOR 240 VOLT OPERATION AVAILABLE AT £3/15/- EXTRA plus postage

MIDGET GENEMOTOR

Input 28 to 32 volt at 1.1 amp output. 250v at 60MA

New in carton **£2/15/-**

Used but in good order **£1/18/6**

Postage extra.

Input filter supplied with genemotors

28 VOLT GENEMOTOR

Input 28 to 32 volt at 1.5 amp. Output 250V at 100MA. Used but AS NEW __ __ __ __ **£1/18/6**

POSTAGE EXTRA

6-VOLT GENEMOTOR

Input 6 volt Output 500 volt at 160 MA.

£6/10/- F.O.R.

HIGH-VOLTAGE GENEMOTOR

Input 12 volt. Output 1200 volt at 200MA.

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VERNIER DIAL

American velvet vernier dial 100 to 1 calibration. Supplied with ceramic coupling **20/-**

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PHONE LM3610

OIL FILLED CONDENSERS

2mfd. 1800V __ __ __	17/6
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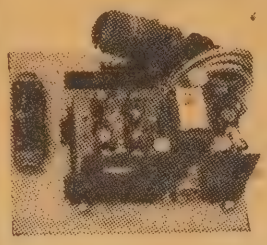
8mfd. 500V __ __ __	10/-
1mfd. 600V __ __ __	5/-
.5mfd. 2500V __ __ __	6/6
.25mfd. 3000V __ __	6/6

Postage extra.

NEW AMERICAN INDICATOR-UNIT



These Indicator Units contain the following Valves:— Six 6SN7GT, one 6G6, one 6H6, one 6X5GT, one 2X2 and 3BP1 C.R.O. tube which is fitted in a separate shield on a 4ft shielded lead and supplied with control box and plug; case and shield are finished in black brocade.

£10/17/6 F.O.R. IN ORIGINAL CARTON

HIGH RESISTANCE HEAD PHONES (3000 Ohms)

THESE PHONES ARE USED BUT IN GOOD CONDITION SUPPLIED WITH HEADBAND AND CORD. .. .. **22/6** per pair.

LOW TO HIGH IMPEDANCE HEADPHONE TRANSFORMER WITH PLUG 5/- plus postage.

Brown's English High-Resistance Headphones 2000 OHMS. Supplied with headband and cord (new in carton). Per pair **37/6**

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New command receivers freq. 190 to 550kc., complete with six valves.

£9/17/6 PLUS POSTAGE

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These Electronic Counters counting from 0 to 9.999 have a 250 ohm coil

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Supplied in grey brocaded box complete with rectifier and transformer for 240V operation, £2/5/-

GRIMES ELECTRIC MOTORS

MADE IN U.S.A.
24 Volts D.C., 1.25 amps.

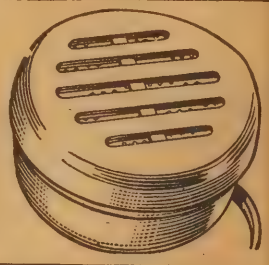
Reversing connections. 11 segments commutator. Size as illustrated, with gearbox 3 x 3¾ 2 inches. Supplied complete with reduction action gearbox to approx. 100 R.P.M., also automatic electric brake for quick stoping. May be used without gearbox where required.

PRICE 37/6 each.
Packing & postage, 2/- extra.

PILLO-FONE EXTENSION-UNIT

IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sickroom, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3¼in Diameter by 1¾in deep. POST FREE 22/6



ENGLISH I.F.F. MOTOR

English I.F.F. motor complete with gearbox. 18v D.C. operation but suitable for conversion to A.C.

£2/10/-

Postage extra

H.F. OSCILLATOR

Small H.F. oscillator suitable for conversion to the 144 mc. Band complete with split stator condenser, vernier dial and 957 acorn valve and socket. **£1/-/-** plus postage.

A.R.7 COMMUNICATIONS RECEIVER

These popular receivers covering from 140 Kc to 25 Mcs in five bands feature single strength meter, crystal gate, noise limiter, two RF and two IF stages. Supplied complete with nine valves, five sets coils, AC/Vib power supply, speaker and mounting rack. AIR TESTED. **£47/10/-**

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Type LM10 complete with original crystal and calibration book. Modulated.

£32/10/-

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PHONE LM3610

"COLLARO"
3/511 and 3/521
3-SPEED CHANGER
Shop soiled

ith lightweight, high fidelity twin crystal heads.

£11/10/-
FREIGHT EXTRA

Synchro n o u s motor and drive in this unit is ideal for tape recorders.

NEW COLLARO SINGLE-SPEED RECORD PLAYERS

Type AC54 single-speed record-player with high-fidelity crystal head and automatic stop. For 240 Volts AC operation.

Special Price
£3/5/0
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ew 7in dynamic speaker by leading manufacturer 00 ohm field coil, 7000 ohm transformer -- -- -- **27/6**

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1 .. .. 9/9	7193 .. .. 5/-	6SH7 in dozen lots
G 9/6	1T4 .. .. .. 15/-	each 5/-
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7G 11/6	6AG7 .. .. 12/6	each 2/6
G 10/6	1K5 .. .. .. 3/6	

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mfd-525V **4/6** each or **48/-** dozen plus post
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NEW GERMANIUM DIODES TYPE 4A42

eal for use as Crystal Detectors, Noise Sup-essors, etc -- -- -- -- -- -- -- -- -- -- **7/6**
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ERAMIC VARIABLE TRANSMITTING CONDENSERS

(Suitable for conversion to split-stator).

0pf. double spaced -- -- -- -- -- -- **12/6**
0pf. double spaced -- -- -- -- -- -- **10/-**
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CERAMIC TRIMMER CONDENSER

late silver-plated miniature variable conden-s approx. 30pf. screw-driver adjust, with lock-screw. **4/6** plus postage.

NEW VALVE SOCKETS

Teleton 8-pin octal moulded sockets **5/-** per dozen or **25/-** per 100.
American 8-pin Loctal high insulation **5/-** per dozen or **25/-** per 100.
Ceramic Acorn Sockets **5/-** each.

CARBON RESISTORS

Well known make of carbon resistors in values of 100 ohms to 5 megohms. In 1-watt, ½-watt and 1/3 watt. All resistors are standard colour coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt .. **12/6**
Post, 1/6.
IN LOTS OF 500, 50/-.
Standard Resistor and Condenser Colour-code card supplied with resistors.

SOLDER

English multi-core solder in 1lb reels.

12/6 per lb

Postage extra.

NEW MERCURY SWITCHES

The switch with a 1000 uses.

2/9 each

SPECIAL PURCHASE 100 NEW "PAILLARD" RECORD CHANGERS

The "Paillard" record changer has a variable speed motor making it ideal for dance halls, etc., and is fitted with a high fidelity crystal pick-up. Sapphire needle supplied with each unit.
BARGAIN PRICE **£7/18/6**

In original cartons — freight extra.

NYLEX HOOK-UP WIRE AT HALF-PRICE

Nylex hook-up wire 10/.010 in 100 yard coils, each coil consisting of five 20 yard lengths in 5 different colours.

10/- PER 100 YDS. Plus postage.

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(At top of Taverner's Hill)
PHONE LM3610

RECORD REVIEWS AND RELEASES

(Continued from Page 93)

BRAHMS—Symphony No. 1 in C Minor, Opus 68. Played by the Berlin Philharmonic Orchestra conducted by Joseph Keilberth. Radiola-Telefunken LSK 7008.

Judged as a standard Brahms performance, this is quite a good disc. The recording is handled well, and general balance is satisfactory except for a few spots where an undue intrusion of secondary parts tends to spoil cohesion. It is fairly forward —perhaps a little too much so to smooth out the moving current so typical of Brahms.

I would have liked a bit more bite to the playing, and flexibility on the conductor's part. I had the feeling that for many bars he was doing little more than beat time. He could have demanded more precision in attack, with advantage, although he must have been well satisfied with the tone quality of the soloists.

It plays best on the EMI setting with a little extra bass, if this can be managed. A couple of tape joins are rather obvious. There is no deterioration of quality near the centre, and apart from a just noticeable hum level, extraneous noises are low.

DEBUSSY — Suite Bergamasque. RAVEL—Gaspard de la Nuit, played by Frank Glazer, pianist. Nixa QLP 4005.

Debussy and Ravel were possibly the two most important of the French impressionists who exploited the movement away from traditional tonality and created a new conception of musical color.

Neither of these suites presents a cohesive mental picture, being more collections of tone pictures. But they form a very good example of the similarities and differences of these contemporary composers.

Frank Glazer presents them in a somewhat matter-of-fact manner, but I would sooner hear them that way than tinged with the drool one often hears with music of this type. He may not be a Gieseking, but he is a most competent pianist all the same.

The recording is very good, another illustration of the fact that the piano isn't the recording bogy it used to be. There is enough reverberation to help sustain the tone as it should be done, and there is no surface noise. A good record.

DVORAK—Violin Concerto in A Minor, Opus 53. Played by George Kulenkampff and the Berlin Philharmonic Orchestra conducted by Eugen Jochum. Radiola-Telefunken LSK 7004.

Kulenkampff will be remembered by many as far back as pre-war days for his fine recordings issued by Telefunken which, in their time, were outstandingly good. They are still good, but this version of the Dvorak seems to date well before the modern microgroove. I would say it is a redub from an early release, and it suffers therefore by contrast. It sounds dull as compared with Radiola's best, and its dynamic range can't compare with the best standards of today. The concerto is tuneful enough, and the performance sound, but it could not pace it with a modern version.

DELIUS—Brigg Fair, An English Rhapsody, On Hearing the First Cuckoo in Spring, The Walk to the Paradise Gardens, A Song of Summer. Played by the London Symphony Orchestra, conducted by Anthony Collins. Decca LXT 2788.

One of the best Delius recordings I have ever heard. Anthony Collins, who bears an almost amusing resemblance to Beecham, shows that he is a strong competitor with the famous man as the accepted Delius interpreter. Music like this requires the most sensitive musical approach and the finest orchestral control. This record has them all, and will hear these well-known compositions in a near-perfect performan Brigg Fair, and The Walk to Paradise Gardens I thought particularly good.

The recording is likewise first-ra and the pressing equally good. isn't necessary to say more than th plus my very strongest recomm dation if you are looking for a Del record for your collection.

MANUEL DE FALLA.—The Th Cornered Hat, ballet by Martin Sierra. Played by L'Orchestre L'Opera-Comique, Paris, conduc by Jean Martinon. Nixa ULP 90

Selections from this ballet often played either as separate ite or as grouped selections, but here the music complete with the vo contributions by Amparito Peris Pruliere. More detailed progr notes would have helped the liste to preserve his sense of continui but it is tuneful stuff and very ea to hear, as Spanish as Spain.

The performance would be mirable as ballet accompanime but for the listener it would ha gained by a little more flamboyan and drive. It is somewhat remo but has a nice baance.

The recording is good if not br liant, with a nice body and ran Surface noise is very low and for t most part inaudible.

JOE "FINGERS" CARR & H RAGTIME BAND—Eight numbe Capitol CLP 020.

Eight popular numbers played authentic ragtime by one of the b popular bands of the day. They i clude Sweet Georgia Brown, Waba Blues, San Antonio Rose and Car dian Capers. Not only is the st good but the recording near-terri Capitol are particularly good at t kind of thing, and this pressing d them musical and mechanical crec

AWA RONETTE
MICROPHONES & ACCESSORIES

Type 088
£8/12/-
Technical pamphlets will be mailed on request. Other types also available from
CHANDLERS PTY. LTD.
ALBERT & CHARLOTTE STS., BRISBANE.
and leading wholesalers.

THE STANDARD AMPLIFIER No. 1

(Continued from Page 77)

is no earthing of the AC circuit at the unit to set up "earth loops" and this form of construction renders the technique less important.

In actual fact, the switch can be wired on the bench and the appropriate connections made to the remainder of the circuit after the switch is fitted to the front panel.

Use ½-watt resistors throughout and, in the case of the switch, use the miniature capacitors now available. These are very little larger than the old size of ½-watt resistors and make the switch wiring easier still.

One of the 25 mfd capacitors fits between the switch and the bracket, while the other is at the end of the bracket as shown in the photographs.

The two 8-tag mounting strips, one on each side of the bracket, carry all incoming and outgoing leads as well as the junction of some of the components.

We mounted the socket of the 12AX7 so that the gap between pins 1 and 9 was toward the top edge of the front panel. Although this is not the only position for the socket, we do know that it allows a satisfactory arrangement of the components.

The lower tag mounting strip carries the output from the unit and the two 6.3-volt heater leads. T upper one carries the junction of t .05 mfd capacitor and the .33 me ohm resistor, the junction of the megohm, .1 megohm, .02 megoh .025 megohm resistors and the mfd capacitor, the earth connection pin 2 of the 6-pin socket to t bracket, and the incoming high te sion lead.

Keep the components wired b tween the socket and the mounti strips tucked close to the chassis, that the 16 mfd capacitor, the l component to go into place, can as close to the bracket as possi to avoid fouling the 5-pin soc mounted in the cover.

The shielded lead from the pic up is brought in through the co toward one corner. Slip a length spaghetti over the braid to avo possible shorting when the cover placed in position.

The connections between t mounting strips and the sockets the cover need only be long enou to allow easy connection with t cover just free.

In making up the interconnecti cable between the unit and the a plifier, don't forget to make the co nection between pin 4 at each e in shielded wire. Because of the l impedance output, there is no ne to use co-axial cable.

ANSWERS TO CORRESPONDENTS

.E.N. (West Brunswick, Vic.) writes congratulate us on the high standard the magazine and to inquire whether can recommend some text books to st him in his studies. He also de- s the symptoms of a faulty receiver. . Many thanks for your comments ut the magazine and we trust it will tinue to help you. It is rather diffi- t to advise you in the matter of text ks since we have no idea of the type course you are taking or the stage study you have reached. If you e to let us have additional details we y be able to help you further. In meantime we suggest that you con- the local bookstalls for text books ch appeal as being suitable. Every dent needs a set of valve data books n the various local manufacturers and ie of the overseas versions also carry uable technical information. Typical these is the RCA Receiving Tube nual.

our receiver would appear to be illating badly and is only stable when strong local signal generates enough C voltage to reduce them to a very level. It is impossible to say what causing this but we would look first an open circuit screen by-pass acitor in the IF stage. A similar lt in the HT paper by-pass (assuming t there is one, if not there should be) any other by-pass in the IF or RF tion would cause the trouble, as would aulty valve shield around the IF valve even the converter in some cases.

I.V. (Smithton, Tas.) complains that has an old set which suffers from a nd like heavy breathing accompanied a buzz. He asks if we can identify it. . It is very difficult to be sure without ually hearing the sound ourselves, it sounds very much like hum com- ed with a speaker voice coil out of nment. We suggest that the set ht be due for an overhaul by some- with a little more experience than rself and that a competent service- n would be able to confirm our gnosis or locate the fault if it is in- rect.

S.N. (Devonport, Tas.) is interested the R-J speaker enclosure described the May, 1953, issue of Radio and bies and suggests a constructional cle along these lines.

. We published the article simply as a reprint of an interesting article but we regret that we have no more information about the original design than that which was published. However, we understand that one of these enclosures has been made and tested by one of the local speaker manufacturers who reports that it is not as good as a well designed vented enclosure. They also point out that later information from overseas suggests that the authors of the original article were a little carried away with their own enthusiasm and that later claims have been somewhat modified, the strong point now being that acceptable results are possible with a very much smaller box than a vented enclosure, but admitting that results are not as good.

C.B. (Carlton, Vic.) is having some trouble in obtaining sufficient volume from a magnetic pickup when fed through its stepup transformer into the pickup terminals of a five valve set.

A. We have not had much experience with the particular type pickup mentioned in your letter but would expect it to have only a moderate output voltage, even assuming the use of a fairly high stepup transformer. Not only would the transformer need to be a high ratio type but it would also need to be loaded in some way or other to favor the bass response in relation to the treble. The use of medium setpup unloaded transformer could be expected to give only relatively weak and "thin" reproduction. Even assuming that the manufacturer has provided for this in one model, there is always a chance that the pickup you have is equipped with a "pickup to line" transformer which would be inadequate for your purpose. Of course the unit could be faulty as you suggest but it is impossible for us to express an opinion on this matter. We are more inclined to the belief that you are expecting more from it than it is capable of giving without a sensitive, properly compensated amplifier.

L.E.H. (Toowoomba, Q.) writes in appreciation of Radio and Hobbies, particularly the sections devoted to amplifiers and associated equipment. He describes his experiences with various combinations including the Williamson.

A. Many thanks for your letter, L.E.H., and we have forwarded the advertisement to the appropriate department. We note your experiences with the Williamson circuit which is, unfortunately, similar to that experienced by many, and are glad to learn that you have had so much success with your present circuit. Your success with the GP20 filter is also gratifying, though we think you will find the new pickups a considerable improvement.

O.N. (Palmerston, Nth. NZ) asks us to publish a constructional article on a portable detector for detecting buried metal objects.

A. Thanks for the suggestion but we have no immediate plans for describing such an instrument. At the moment we cannot think of any source of information on them to which we can refer you. As far as we can recall the mine detectors used by the Australian Army consisted essentially of two oscillators. One was controlled by a tuned circuit consisting of a compact coil and capacitor and the other by a capacitor and a large loop of wire which was used as a search coil. The output of the two oscillators was combined, detected and applied to a pair of headphones. Initially they were adjusted to operate on the same frequency but the presence of a metal object near the search coil altered its inductance and resulted in a beat note in the phones, the frequency of the beat being dependent on the size of the object and the distance.

D.C. (Jordanville, Vic.) wants to know the formula for calculating the number of turns on aerial and oscillator coils for a given diameter and a given freqency.

A. The problem is not so simple that it can be solved by substituting a few figures in a formula. The inductance of the tuned winding can be calculated or arrived at by means of an alignment chart an excellent example of which is to be found in the American Radio Relay League handbook. Knowing the inductance, you can find the number of turns for a given size former and wire. A suitable formula is also given in the handbook. However, additional windings are required for aerial coupling and feedback in the case of the aerial and oscillator coils respectively and although it would be possible to calculate the dimensions of these coils, most engineers find it easier to arrive at the correct values by experimental procedures.

J.D.H. (Norwood, SA) has built the Rambler portable and reports that it has given several months of excellent performance and that he can receive several Western Australian stations using a Ferroxcube rod aerial. The only thing which mars the performance is the recent development of a microphonic 1S5 valve and he wants to know if there is any solution to the problem.

A. Apart from a new valve, J.D.H., we can only suggest that you try one of the spring-mounted seven-pin sockets which are frequently used in pre-amplifier stages. The only snag is the larger size of the mounting plate and you may need to modify things slightly to accommodate it.

J.G. (Geraldton, WA) wants to know whether we have ever described the construction of echo sounding apparatus as used to determine the depth of water under a vessel and to locate shoals of fish.

A. No, J.G., we have never described equipment of this kind nor have we seen any text books dealing with the subject. We suggest that you may find some reference to it at your public library but it appears to be a subject which has been neglected by writers, probably because the construction of the equipment is likely to be beyond the scope of the average home constructor. We are glad to learn that the other pieces of equipment you have constructed have proved so successful.

R.H. (Guildford, NSW) submits a circuit of a 4-valve AC receiver for the Reader Built It page of the magazine.

A. Many thanks for your interesting letter R.H. We are filing the circuit you enclosed in view to possible use at a later date.

THE "RADIO & HOBBIES" QUERY SERVICE

ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to others readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

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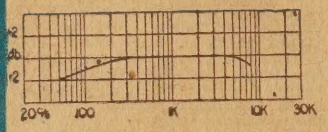
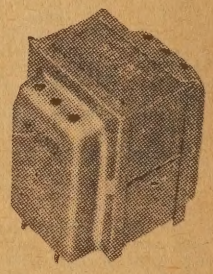
PUBLIC ADDRESS RANGE
50-8000 C/S ± 2 dB

This range is designed for use with public address systems, factory music while you work, etc. A small section of our extensive range is presented below.

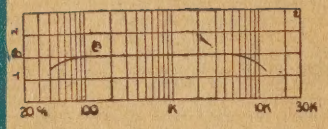


Code No.	Watts	PRIM. Z.	SEC. Z.
OP-1	10	5000, 2500 SE	12.5, 8, 2.3
OP-1A	10	5000, 2500 SE	500
OP-2	15	5000 PP	12.5, 8, 2.3
OP-3	15	6600 PP	12.5, 8, 2.3
OP-4	15	10000 PP	12.5, 8, 2.3
OP-11	25	6600 PP	500, 250, 125
OP-12	25	10000 PP	500, 250, 125
OP-15	32	6600 PP	500, 250, 125
OP-16	32	10000 PP	500, 250, 125
OP-37	80	6400 PP	500, 250, 125

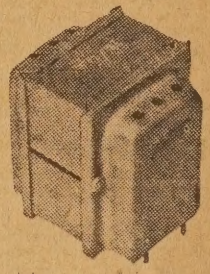


MEDIUM FIDELITY RANGE
40-12000 C/S ± 1 dB

This range has been especially designed for use with the Rola 12-OX speaker. These transformers are especially suitable for use with triodes.

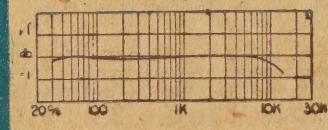


Code No.	Watts	PRIM Z.	SEC. Z.
OP-112	6	10000 PP	2
OP-113	6	5000 SE	2
OP-117	6	5000 PP	2
OP-118	6	8000 PP	2
OP-119	6	6600 PP	2
OP-183	6	7000 SE	15, 2

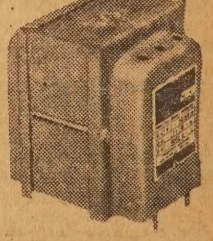


HIGH FIDELITY RANGE
30-15000 C/S ± 1 dB

These transformers are primarily for use with Goodman and other extended frequency response speakers. Section below is only small part of our range.

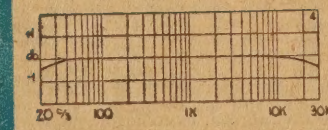


Code No.	Watts	PRIM. Z.	SEC. Z.
OP-22	10	3250 SE	500, 25, 2.3
OP-23	10	3250 SE	12.5, 8, 4, 2.1
OP-19A	15	5000 PP	12.5, 8, 2.3
OP-19B	15	5000 PP	500, 250, 125
OP-21	15	8000 PP	500, 250, 125
OP-62	15	10000 PP	500, 125
OP-63	15	10000 PP	15, 3.75
OP-64	15	10000 PP	12.5, 3.125
OP-65	15	10000 PP	8.4, 2.1
OP-51	20	4500 PP	15.5, 12.5, 8.6, 2.8, 2

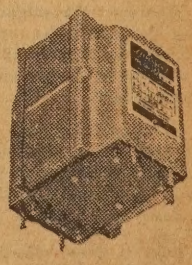


SPECIAL HI-FI RANGE
20-30000 C/S ± 0.5 dB

These transformers are for use in the Williamson Amplifier, and fulfil every requirement specified by D. N. T. Williamson.



Code No.	Watts	PRIM. Z.	SEC. Z.
OP25/500	15	10000 PP	500, 125
OP25/250	15	10000 PP	250, 62.5
OP25/40	15	10000 PP	40, 10
OP25/16	15	10000 PP	16, 4
OP25/15	15	10000 PP	15, 3.75
OP25/12	15	10000 PP	12, 3
OP25/10	15	10000 PP	10, 2.5
OP25/8.4	15	10000 PP	8.4, 2.1
OP-66	15	5000 PP	8.4, 3.7
OP-67	15	5000 PP	15, 6.5



Ferguson Transformers Pty. Ltd., Ferguson Lane, Chatswood—Phone JA8491. Available from retailers in every St

ERE'S YOUR ANSWER TOM

(Continued from Page 53)

nfortunately "Q-Meters" cost a of money, and are, therefore, available to experimenters. ther are the other laboratory ruments which we mentioned. s a result, experimenters usual- have to take products for grant- and learn, by actual use, what nd or type of coils seem to e the best results for their pur- e.

n experienced eye can some- es pick good and bad features, once again, that isn't much help ause you wouldn't be asking the stion if you could draw on a of experience.

RE TO IT

f course, you mustn't forget, n, that there is more to a coil n just a good electrical "Q" er test. Its mechanical construc- is also very important. it easy to mount and align? the adjustments "stay put", or they likely to change with time vibration? Is the wire well- ed against moisture? How dur- e is the outer can, and how like- is it to corrode? Are the solder firm or will they loosen with t?

hese are all important factors a set manufacturerer want- to buy coils and IF transform- is likely to prefer a unit which mechanically reliable and elec- ally acceptable to one that is electrial masterpiece but a me- nical travesty.

don't think we can help you ch more on that one.

ELEVISION COURSE

(Continued from Page 39)

izontal deflection circuits, passed ough shaping amplifiers and ap- d to auxiliary control electrodes hin the picture tube.

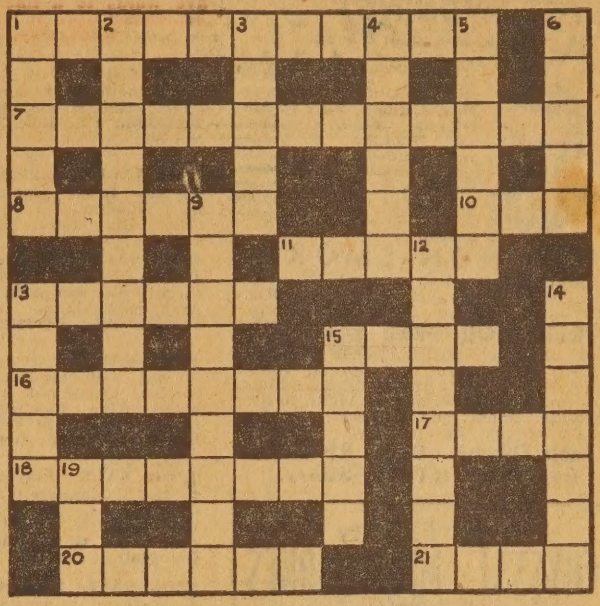
hese auxiliary circuits keep the m in focus and limit its travel it approaches the edges of the ure area.

further point is that the tubes rently require a much higher m curent than conventional black white kinescopes, and this leads problems of power supply sta- ty. Because of this, regulated e power supplies are advisable to vent troublesome fluctuation in ure brightness.

Last Month's Solution

R	I	D	L	E	A	K		A						
	N		E			I	O	N	I	C				
	D		C			L		N	E	O	N			
O	U	B	L	E	P	O	L	E		P				
	C		A			C		X	R	A	Y			
	T	I	N			Y				L				
	I		C	I	R	C	U	I	T					
	O		H			L			E					
E	N	C	E		R	E	M	O	T	E				
		C				E		R						
A	S	T	E	R		T	O	O	L	S				
R		L		F	E	E		D		U				
C	O	I	L			R		E	O	N				

THE R. & H. CROSSWORD No. 6



ACROSS

1. Output from transmitter
7. Pattern on oscilloscope
8. Pioneer of recording
10. Type of aerial
11. Germanium tube
13. For controlling circuits
15. Aerial support
16. Connected in shunt
17. Graphical calculator
18. Type of regenerative circuit
20. Crystal detector
21. Gassy valve

DOWN

1. Filter element
2. Changes AC to DC
3. Girl's name
4. Collects signals
5. Type of insulating cloth
6. Protected against overload
9. To be unstable
12. Potentials
13. Superintendent (slang abbrev.)
14. Diagram
15. Name of theatre
19. Unit of work

Solution and further crossword next month.

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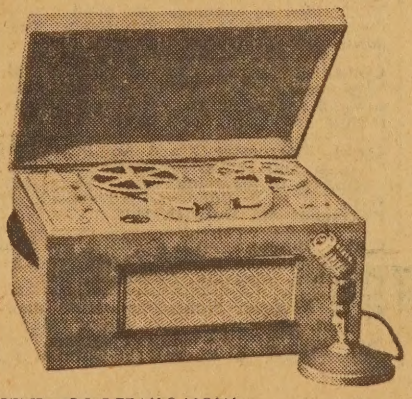

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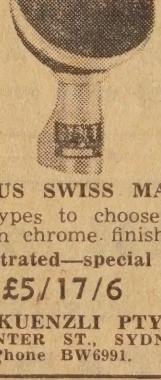

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FOR SALE: New "Pyral" paper-based magnetic tape, limited quantity only, 7-inch full spools, 46/6 ea., post free. **Transonic Co., Box 30, P.O., Balgowlah, N.S.W.**

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FOR SALE: Tape Recorder, Amer. Pentron, Dual Track, Fast Forward, Radio Circuit for reception or recording. Ex. Amp. and Phone Jack, use as public address, **£85. FW5212, 8 am daily.**

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FOR SALE: Playmaster Control Unit No. 3, completely assembled and tested with knobs, but less escutcheon, £12. Will forward freight paid anywhere in Australia. **G. C. Findlay, Edmund St., Caloundra, Qld.**

FOR SALE: 1 developing tank, 1 filter-holder, 1 window, 3 photo guide-books, 1 packet F3 paper, 1—HP3 film, 1 Weston exposure meter, 1—250V. A.C. grinder and polisher, new, 1 Pifco radiometer, 1 milliameter, 100 Science Fiction books, 1 jeweller's outfit. Best offer takes all or any. **J. Kokje, c/o G. D. Jennings, Post Office, Bencubbin, W.A.**

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